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OUR FIRST RESERVE.

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AFTER having long been kept out in the cold, there seems at last some prospect of the Militia being admitted to the sunshine of national favour, for the question of Military Reserves has come to the front, and the most competent authorities are agreed, not only that an Army of Reserve is requisite, but that the Militia is the source from which it is to be obtained, and as a Militiaman I hope that I shall not be considered presumptuous if I offer a few remarks on the present organization of the Militia, and its adaptability for the purposes of an efficient Reserve.

It may be as well, in the first place, to inquire why it is we require a Reserve, and to define the terms "Reserve" and "Militia."

There is very high authority for stating that we require a Reserve, because on a sudden call, any of the great continental nations can muster their hundreds of thousands in the field, while "perhaps we might assemble in the United Kingdom some 40,000, or at most 50,000, effective men of all arms of our regular forces" (*vide Report of Commissioners on Military Recruiting*); because "it has become absolutely necessary to place ourselves less at the mercy of events than we appear to be at the present moment" (*the Times*); because experience has warned us "that in future wars will be so sudden, so sharp, and so short, that there will be no time for preparation" (General Peel's speech, Nov. 9th, 1866); and because "the history of the recent war in Germany has taught us that whatever combatant force is maintained, the complete equipment and machinery for a much larger one must be prepared and kept at all times ready for immediate use" (*Edinburgh Review*).

As I understand the word "Reserve," it means, an inexpensive auxiliary force, capable of rendering immediate assistance to the regular forces in cases of sudden emergency—in fact that, like a fire brigade, it can turn out at a moment's notice.

The Militia may be shortly described as a force called out each year for 27 days' military training, and commanded by officers appointed by the Lords Lieutenant of counties.

This force has been styled by the highest military authority "Our

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first Reserve," and concisely defined by the *Times* newspaper as "a dormant element of national strength, available at an hour's notice, and yet not trenching to any serious extent upon the resources of the Treasury or the industry of the population." This is the official and traditional, and what may be termed the public-dinner-theory respecting our Militia ever since its first establishment in the days of Charles II., and if it were but true, would define a force whose value could not be too highly estimated, and whose reformation would be a work of supererogation. But, unfortunately, it is not so highly estimated by the nation, and, to tell the plain truth, is regarded by many of those who think about it at all as a mouldy and unmeaning relic of the past, and by not a few as an unmitigated nuisance. It is not saying too much to affirm that it absolutely counts for nothing with military men, and of those connected with it, from the Minister of War to the lowest drummer boy, there is not one who can really believe that it is an "element of national strength available at an hour's notice." There is not a man in the community who regards it with pride or security. The regular Army look upon it with undisguised contempt, the civilians who are not brought into contact with it regard it with derision, the civilians who are, with aversion, for in too many cases it symbolises to the inhabitants of those districts in which the annual musters are held all that is debauched, lawless, and degraded.

Without at all admitting that the Militia merits such general scorn and sweeping censure, I fear that public opinion is in the main, correct as to its utility.

I will endeavour to show that such is the case, and that the shortcomings of the Militia are not attributable to lack of zeal on the part of its members, whose hands are tied behind their backs, and who are perfectly helpless in the matter, but to the persistent disregard on the part of the nation, of those indispensable conditions, already quoted from the *Times*, without which an efficient force is an impossibility.

These conditions are, 1st, that the force be dormant; 2ndly, cheap; and, 3rdly, available at a moment's notice. If it be not the first and second, it is nothing less than a standing Army. If it be not the third, the country in the hour of need will derive but little benefit from its antecedent cheapness and immobility, and it follows that if any of these essential conditions be wanting there can be no efficient Reserve, and it appears to me that it is because the third and most essential, because the vital condition, has been neglected from the days of Charles II. to the present time, that our Militia has been through all those 200 years, a bye-word and a reproach among the people, instead of being a source of national pride, and a strong tower of national defence.

What are the principles on which the Militia was organized and is still maintained, but those of Feudal ages and of patriarchal days long prior to the Feudal ages, when nations were enumerated as so many hundred thousand fighting men, besides women and children—when every able-bodied man was both soldier and civilian, and the nomad shepherd of yesterday was the Captain of the Host of to-day?

No better system was obtainable or possible for those primitive times, and it was equally well adapted to the Feudal ages, when every inch of land was held by military tenure, when every man's hand was against his neighbour, and when it behoved him who cared to live, to know how to fight. Unquestionably the artisans and clod-hoppers of those rough times were as skilful, perhaps more so, in the use of the sword and spear as of the shuttle and the hoe. But when the Feudal system mouldered away, and was superseded by that of standing Armies—when the man of peaceful pursuits did his fighting by deputy instead of with his own right hand, there was then no longer any necessity that he should be skilled in the use of arms, and he speedily became slack in military matters, and ultimately lost all knowledge of them. It could not have been otherwise. A man cannot be a soldier any more than he can be anything else by intuition, and when soldiering was no longer compulsory or generally necessary, it was not to be expected that the agriculturist or artisan would voluntarily take to it as a profession. Thus the third and most vital essential of the old system, namely, that every citizen was available at a moment's notice, died out. But the fact was ignored at the time, as it is now, and the skeleton of the feudal system was preserved, under the name of *Militia*, though the vital spark was extinct. Cheapness and the dormant condition were easily maintained, and efficiency was expected to follow as a necessary consequence. But that it did not do so, even in a generation who could remember Naseby, and had taken a part in the Battle of Sedgemoor, is apparent from the literature of the period. Dryden's Militiaman is pretty much the same as Punch's in our own day—

“ Raw in fields the rude Militia swarms,
Mouths without hands maintained at vast expense;
In peace a charge, in war a weak defence,
Stout for a month, they march a blustering band,
And ever, but in time of need, at hand.”

Very different were the terms in which Shakespeare spoke of the raw levies of the 15th century. They are, indeed, covered with ridicule, but not on the score of inefficiency. They are “slaves as ragged as Lazarus in the painted cloth,” “discarded, unjust serving-men,” “women's tailors, revolted tapsters,” &c., but they are not “mouths without hands,” even the country bumpkin Wart, “the little lean old chapped bald” Militiaman is a proficient in the Manual of the day and “manages me his caliver exceeding well,” and Falstaff, though he would not march through Coventry with his raw recruits, did not hesitate to lead them, without a day's training, to the front of the battle, where if being “peppered” almost to a man, is any test of stout fighting, they fought as well as the best. Shakespeare's Militiaman was available at a moment's notice, and Dryden's was not, because the Feudal age necessitated every man in the community being expert in arms, and the standing-army-age did not necessitate individual efficiency, inasmuch as the battles of the country were to be then fought not by the nation at large, but by the professional soldier, especially trained and paid for that purpose.

To be available at a moment's notice is, and always has been, the main spring, the very life, of every military organization, active or dormant; but this vital principle is not intuitive. It must be infused into the system, and be carefully cherished there, or it will languish and die, and the system with it. An untaught country lout cannot fight on equal terms with a trained soldier, nor can he obtain those equal terms by being hustled about in a drill field for 27 days in a year. There is no royal road to a knowledge of soldiering any more than there is to anything else, and yet from the days of Charles II. to the present, England has been saying to her first Reserves, "I have made you cheap, I have made you dormant, make yourselves efficient," and presupposing the possibility of doing this, has wrapped herself up in the delusion, that she possesses in the Militia an element of national strength available at a moment's notice.

On that point I take issue, and I venture to assert that our Militia, or any Militia so constituted, is not, or ever has been, or ever could be, *quâ* Militia, an element of national strength, or an efficient Reserve for an unforeseen emergency.

It may indeed be urged, that the Militia did yeoman service in the wars of the first Napoleon, by releasing the regular forces from home duty, and furnishing them from time to time with recruits fairly disciplined. Nor can it be denied that in these respects it was of some use, but a force that had been embodied for nearly a quarter of a century was virtually more a standing Army than a Militia, though to the last, from the inherent defects of its system, ever an unreliable force. And the question is not whether during that protracted period it became serviceable to a certain extent, but whether it was when first embodied, or for long after, an efficient reserve able to cope with an emergency at a moment's notice. In those days, that word emergency had a very different signification from what it bears in our times. War loomed long in the distance before bursting over a country, and then dragged its slow length along for years without any decisive results. There was ample notice, and ample time and opportunity for working up raw materials, but as far as I know, no one ever dreamed of bringing the Militia to the front, or placing it in any post of danger, except in the case of the French invasion of Ireland, when the results were, to say the least, not encouraging; and I doubt if there are many Militia regiments who took part in that campaign, who would care to emblazon on their colours the actions in which they were engaged, nor do I know any portion of the United Kingdom in which the Militia is held in such contempt as in that part of it where for the first and last time it took the field against a foe. Even at their best, the nation had no faith in its constitutional defenders, they were still a bye-word, a reproach, a reed on which the country refused to lean, and after the peace of 1815, they were suffered to melt away without lament into total nothingness and oblivion.

Nor when exhumed, during the Crimean war, was their organization in any way improved. At the time of their embodiment and for long after, they were notoriously a rabble and nothing more; and if after two years of constant training and discipline, some few regiments

amongst them vied in some degree in efficiency with the line, it was owing to their voluntarily availing themselves of the opportunities afforded by such a protracted embodiment; the great majority, however, who to the last failed to approach to such, or in many instances to any measure of proficiency, are a strong proof how little the authorities regarded them in the light of a *first reserve*, or thought it worth their while to take any proper steps to make them so.

I freely acknowledge that much has been done since then to put the Militia on a better footing. Previous to the Crimean war it was a perfect myth. The Adjutants, who had nothing earthly to do but draw their pay, were all that remained (in memoriam) of the great constitutional force. Since then, annual trainings and inspections have been revived, efficient staffs constituted, recruiting admirably organized, clothing, arms, drill, discipline, interior economy, personal comfort of the men carefully attended to, a special department created with a distinguished General Officer at its head to supervise and control the force, and yet, if an emergency arose to-morrow, where is the Militia regiment in the United Kingdom available to grapple with it? Is there a General in the Service who would venture into action with the flower of our Militia as it now is, against the worst disciplined regular Army in existence, European or Oriental? Improvement has just stopped short of practical utility, every step has been in the right direction, but none have gone far enough. The organization has become more perfect every year, and yet has stopped short of efficiency, and all that has been done is fruitless, because no opportunities are afforded us of availing ourselves of this admirable organization.

It must be borne in mind that the Militiaman, except he be taught by authority, has neither inducement, nor means, nor capability, of teaching himself. When his training is over, he lays aside his rifle and his uniform, and is not permitted to use either one or the other until called up for training again. Nor is he the stuff out of which Volunteers are or could be made; a man who of his own accord hires himself out for one shilling and two pence per diem, cannot afford himself the luxury of amateur soldiering, and yet notwithstanding the patent fact that he is of himself perfectly helpless, and also the experience of 200 years, a great blot remains untouched, and the Militiaman is still expected to learn the whole duty of a soldier in twenty-seven days. Recruit and company drill, battalion and brigade exercises, some knowledge of musketry, experience of the interior economy of a regiment, *esprit de corps*, and habits of discipline are all essentials for the soldier, they cannot be dispensed with, and they cannot be acquired in twenty-seven days. Something may be done as to drill. As a Musketry Instructor, I can safely say that next to nothing can be done with musketry, and that under the most favourable circumstances it would take five years to put a ten company regiment once, and imperfectly, through the course. As to habits of discipline, without which a soldier on active service is worse than useless, how can they leaven the whole man as they ought in twenty-seven days, or at all when, as is too often the case, a Militia regiment is billeted during its training on the public-houses of a country town? I trust I may not be con-

sidered presumptuous if I say that I cannot see how the Government scheme of an Army of Reserve, as far as it has been developed, is calculated to meet matters. The Militia are to be recruited up to their full number, but how will that increase individual efficiency? 100 sheep are as helpless as 50 against the wolf. Thirty thousand men (about whom I have a word to say presently), are to be picked out from the rest, and, in some way not specified, to be made more efficient than their fellows, but bearing in mind the modern acceptance of the word "emergency," how does this secure the efficiency of the remaining 90,000 men who are debarred from similar advantages. The control and organization of the Militia have indeed been handed over to a distinguished General Officer, but much on the same terms as the making of bricks was entrusted by the Egyptian taskmasters to the Israelites of old. The task is that 130,000 rough clods are to be worked up into efficient fighting men in twenty-seven days; a task which we have been for 200 years endeavouring to accomplish, which we have hitherto totally failed to accomplish, and which no nation in the world in any age has ever accomplished; yet this is the task required of the New Reserve Department. We must clearly understand that this is the task and no other. In these days when wars burst like a thunderstorm without warning over our heads, and are matters of but a week or two, and in a country which could barely oppose 40,000 regular troops to an invading Army, a Reserve Force must be something more than a nursery for the line, or the germ merely of future organization; it must be a good thing and not merely the promise of good things to come, a present and not a prospective help in time of trouble: in a word it must at all times be a Service, capable of independent, though subordinate action, able at a moment's notice to defend garrison towns, as well as occupy them; to back up the Regular Army in the field, as well as feed them with recruits. If a Reserve cannot do this it is but an imposture and a make-believe, and would prove as worthless for defence in the hour of need, as would the men in armour of a Lord Mayor's show.

This is but the simple truth, and yet the nation will not look the truth in the face, but persists in demanding bricks while it refuses straw. In fact the Militia question has never been fairly dealt with yet, it has never been discussed on its merits or probed to the quick; it is the political red-hot poker which statesman after statesman has grasped only to drop again.

Whenever the Militia question crops up in Parliament or elsewhere, it is jumped upon, stifled, and buried out of sight as speedily as possible. No one dares to grapple with it, to strip it of its theoretical and traditional trappings, and expose it as the arrant cheat, the miserable sham, the poor helpless, lifeless scarecrow that it really is. Individually we know this to be the case, and very freely acknowledge it to one another in our individual capacities, but as a nation we ignore the fact, because if acknowledged it would present itself as a very ugly fact, which could only be got rid of by decisive measures, to which we are not inclined, in other words by *opening our purse strings to the Militia.*

This is the great lion in the path.

No statesman has been able to bring forward a comprehensive scheme of Militia organization; he has been obliged to speak evasively and mistily, and with bated breath to veil the whole truth, to propose measures which are totally inadequate and admittedly makeshifts, because he knows that the nation has no faith in the Militia, and will not submit to costly experiments on its account. In this country everything is a matter of FAITH and MONEY. Where there is faith, there money will be poured forth like water; where there is no faith, the purse strings will not be relaxed, let the charmer charm never so wisely. We believe in blue books and naval experiments, and, though warned by experience that both might prove valueless, would sell the shirts off our backs to indulge in either one or the other. The Militia, though we affect to regard it as the great constitutional force of the country, we do not believe in, and refuse to dole out more than a beggar's alms for its maintenance. And the instructions to those who administer or would reform its system, appear to be virtually the same as those which Lord Hotham asserts were given to the Royal Commission on Recruiting—"Mind you don't recommend anything which "will entail an increase of expenditure." We cling to the shadow, but reject the substance, and the result of all the commissions, and schemes, and legislation, of late years, has been that though there has been much tinkering, LIFE has not been infused into the Militia, a corpse has been galvanized, the outside of a cup and platter cleansed, a sepulchre whitened, and that is all.

It is really time that there should be an end of all this. If we have no faith in our Militia let us say so openly, and throw it overboard at once, and, if possible, obtain our reserve from some other source. But if we are determined to mould the Militia into an efficient reserve, let us manfully look its deficiencies in the face and seriously address ourselves to remedy them if we can, and above all, let us give it fair play. Don't let us play fast and loose with it, or set it a task to do and then tie its hands behind it, but deal with it on its merits, and endeavour honestly to make it an element of national strength available at a moment's notice.

When we reflect that 136,000 men of the Line (to speak of the effective services only) cost upwards of £10,000,000 annually, and 134,000 men of the Militia cost not quite £1,100,000—that the men of the Line drill 365 days in the year and the men of the Militia 27—that the men of the Line acquire *esprit de corps* and habits of discipline by constant supervision and association in well-ordered barracks, while the men of the Militia, billeted through the slums and public-houses of country towns, run riot uncontrolled—that the men of the Line are officered by professionally trained soldiers appointed by a soldier, and the men of the Militia by untrained civilians appointed by civilians—and further reflect that this organization of the Line is essential to its efficiency, it will not be difficult to place our finger on some of the principal blots on the Militia system.

But if these points of comparison between the Line and the Militia show some of the sources of the latter's weakness, they appear to

me to indicate also the sources from which it is to obtain increased vigour and vitality. I will take these points *seriatim*. The first two, inadequate estimates and inadequate training, are inseparable, and must be considered together. But here the tax-payer and the political economist stop the way. The tax-payer will not submit to a material increase in the military estimates, and the political economist will object to the prolonged withdrawal of 130,000 men from the labour market. I will endeavour to show that neither the estimates nor the labour market need be affected to any excessive degree. If the experience of all times proves conclusively, as I think it does, that a knowledge of soldiering cannot be intuitive, recent events have, on the other hand, clearly shown that a man can be rendered efficient for active service in far less time than was thought to be possible even a few years ago. As Lord Hartington remarked in his speech on General Peel's scheme for organizing a Reserve, "If the German war proves anything, it is, I think, the fact, that in the Prussian campaign in Bohemia, it was clearly shown that an efficient infantry soldier might be obtained by an amount of drill not exceeding three years—indeed, a great part of the Prussian Army was composed of men who had only served one year."

Nor must it be forgotten that the Landwehr of the first call, with less service still, and who are essentially a Militia Reserve force, bore a conspicuous part in the campaign, and contributed largely to the success of the Prussian arms; and I think that most military men who have been connected with the Militia, or have been in the habit of inspecting them at their annual trainings, will be of opinion, that it is amazing what an amount of drill and general knowledge of soldiering can be picked up by a man even in 27 days—picked up to be, alas! only dropped again, for 27 days are not sufficient to give a man time to absorb and retain the knowledge and habits he has acquired. The real problem is, how to give the Militiaman a leavening of soldiering that will make him serviceable on an emergency without seriously trenching on the resources of the country. This problem Prussia has solved, and the other nations of the continent are solving for themselves, and while to graft the feudal and coercive systems of the continent on the voluntary system of Great Britain would be impossible, I think we might take some useful hints from them, and adopt with advantage some such plan as that on which the new French Garde Mobile is based. I would therefore suggest that instead of a uniform training of 27 days every year, one third of the Militia force should be embodied annually for *three months*, another third for two months, and the remaining third for one month. In other words, to have in 1869, say 50 regiments out for three months, 50 for two months, and 50 for one month, and the regiments that were out for three months in 1869 to be out for two in 1870, and for one in 1871, and so on with every regiment in succession. By this system every Militiaman would receive triennially a three months' brushing up, and learn lessons which he could not, if he would, forget, and acquire habits which he could not, if he would, shake off, and which would be kept alive by the reduced terms

of training in the two intermediate years. But, above all, there would then be time to impart to the Militiaman some knowledge which he does not now possess, of brigade movements, for battles are not fought by isolated regiments, but by associated regiments habituated to brigade movements; while Militia training at present is purely regimental and isolated. Each regiment, even when there are several in the same county, drills by itself, and association with other corps is unknown. An experiment has, indeed, been made, last year and this, of sending several regiments to Aldershot, to be brigaded during their training with regiments of the line. This is, no doubt, a step in the right direction, but a very short one. No benefit can accrue from it to the Militia generally. There are but two camps of any size in the United Kingdom, Aldershot and the Curragh, and the distance and expense are too great, and the time too short to send to either camp any regiments except such as are in their immediate vicinity. As a matter of fact, all the regiments that went last year and this to Aldershot were within easy distance of the camp, and in some instances, the same regiments have been selected both years. But the benefit that even these favoured corps can derive from their camp life will be very trifling. Their whole term of embodiment occupies but 27 days. The first two are taken up in mustering, clothing, and arming, the last two in unclothing, disarming, and paying off; then three Sundays have to be deducted from the balance, and if every remaining day should be fine—and who is there that believes in the possibility of such a thing?—there will be twenty clear days left for moulding the Militiaman into an efficient fighting man, able to cope with an emergency at a moment's notice.

The time allotted is too short—too short, in fact, for anything but an imperfect grounding in company drill, and a superficial knowledge of a few of the simplest battalion movements, to show off on the day of inspection. The Militiaman may indeed get a slight inkling of camp life, and the Linesman may see that the Militiaman is the right material if properly handled, but beyond that but little good will be effected. But in three, or even two months, much might be done. There would be time to form temporary camps in districts where no permanent one exists, and men could, in a great measure become habituated not only to the drill but to the discipline and duty of a soldier. They would have the great advantage of being brought into close contact and fellowship with the professional soldier, and of being familiarized with a soldier's life, and I cannot but think that happy results would follow from such protracted association, that prejudice and contempt would give way to more generous feelings. The Linesman might be brought to look upon the Militiaman not as a clumsy caricature of himself, but as a valuable auxiliary; and the Militiaman would gain the inestimable benefit of feeling that he belonged to a force that was really looked upon as a Service, and which could, if called upon, take its part, though a subordinate one, in the defence of the country.

If this system was adopted, I do not think the political economist or the tax-payer would have much ground for alarm; for though the nominal strength of the Militia is 134,000 men, I doubt if there will

ever be much more than 100,000 embodied in any one year: but even if the full number entered an appearance, the derangement caused by the withdrawal of 40,000 men annually for three months from the entire population of the United Kingdom, could be but slight. Many Militiamen have no fixed employments; those who have, can, as experience has proved, be very well spared by their employers for the present term of training, and the man who can be spared for 27 days in each year, can easily be spared for 81 days once in three years without inflicting any very serious loss on the agricultural or commercial portion of the community, which would be amply compensated for the inconvenience it might have to put up with, by the increased efficiency of those upon whom in some degree they rely for security and protection. Nor do I think there would be any difficulty with the men themselves. A spirit of soldiering, which is becoming stronger every day, is abroad. Even Militia soldiering is much more popular among the men than it was a few years ago, and the great majority of Militiamen whom I have come across, would much prefer a three months' to a one month's training, and would not require the incentives of additional bounties and allowances to reconcile them to a prolonged term of duty.

As to the question of expense, if we refer to the estimates, it will be seen that the total charge for the Militia for the year ending March, 1868, amounts to £986,762, including a sum of £5,565 for the pay, &c., of the Inspecting Staff of Reserve Forces (a portion only of which is justly chargeable to the Militia).

Of the total charge, the Establishment absorbs, } including bounties, expenses of enrolment, &c.	£286,365
Permanent Staff pay, allowances, clothing, medical } expenses	246,977
Volunteers' pay, allowances, medical expenses ..	217,700
Ditto clothing	191,720
Pay Recruits and Volunteer Non-commissioned } Officers' preliminary drill	24,000
And additional charge for those Volunteers in the } Militia who may engage to serve in the Militia	20,000
Reserve force	
	<hr/> £986,762

The first two items are fixed charges, and would be but slightly, if at all, affected by any extension of training. Whether the drill is for 1 or 27 days, the charge for bounties, general and permanent staffs, &c., will remain the same. It is the number of men, and not the number of days, that determines the amount of the bounties, and the pay and allowances of the general and permanent Staffs are estimated for every day in the year, and cannot be affected in any way by any diminution or extension of the term of training; and for the purposes of a serviceable Reserve, the fixed establishments appear to me to be as complete and efficient as they need be, and require little, if any, further development.

Then, though at first sight it might appear to do so, I think the charge for clothing (£191,720) would not vary.

A soldier of the Line receives a new uniform every twelve months, a Militiaman, nominally, every five years, but virtually every five months, as he is only called out for duty one month in each year. There is no reason why a Militiaman's uniform, making every allowance for the disadvantages he labours under, should not last nine months to the regular's twelve, and in that case no alteration as to the issue of clothing would be required. As to the shirts, socks, and boots that are supplied annually, they would be the merest rubbish if they could be worn out during the term of a three months' training.

The item of £20,000 for Reserve Volunteers would of course, under the system I propose, disappear, and the charge £24,000 for the preliminary drill of recruits (£21,000) and volunteer Non-commissioned Officers (£3,000), remain as it was.

There would then be left but the item of £217,700 for volunteers' pay-allowances, &c., which could in any way be affected by an extension of training. According to the scheme I venture to suggest, this sum would be exactly doubled, and £217,700 represent the increased annual charge for the Militia, minus the £20,000 before referred to, and there might also perhaps be a further reduction (though I would deprecate it) of £21,000 by dispensing with the 14 days' preliminary drill for the recruits.

There is, however, the Government scheme and its cost to be taken into account, on the other hand. As I understand it, 30,000 men are to be selected from the Militia force, who are to receive double bounties, and in some way, not yet made public, to be made more efficient than their fellows. The double bounties will amount annually to £30,000, and a month's additional training—and it could not well be for less than a month—would cost at the least £70,000 more. So that the difference between making the whole Militia force and a fourth of it, efficient, would not amount to more than £97,700.

But this is not all, for even if the Government scheme could be carried out without any increase of expenditure whatever, it would still be in my opinion most objectionable; for, admitting that 30,000 men were made efficient, the condition of the remaining 100,000 would be rendered far more hopeless and helpless than it is even at present. An efficient reserve, as I understand it, is a force that stands on its own legs, and is not to be cut up into small pieces to prop up the legs of another force. If you want a Militia regiment to be of any use, keep Officers and men together, and train them properly; but, if in a corps you exalt a certain number of men above their comrades, and, in case of war, detach them altogether from their regiment and merge them in the Line, you destroy the efficiency and *morale* of the remainder, and you create jealousies and heart-burnings amongst the men, and disgust amongst the Officers. It is not very encouraging to 100,000 men to be stigmatized as the refuse of a force which is sufficiently contemptible as it is in the eyes of the public, nor to zealous Officers to have the *sic vos non vobis* principle applied to them, and to have to submit to the humiliation of being considered unworthy, when real work has to be

done, to lead men who had in a great measure been made efficient through their exertions. No Officer with a spark of *esprit de corps* would care to act merely as a dry nurse for the regular Army without a chance of ever seeing actual service, and neither Officers nor men could ever feel an interest in a corps which in no event, as a whole, could act together in the field. Cohesion is as essential to the Militia as to any other agglomeration of atoms. Separate its men and Officers, and it is as a bundle of sticks, whose fastening has been loosened. Shoulder to shoulder with old comrades, and led by Officers to whose control he has become habituated, the Militiaman will be turned to far better account than by the irritating and invidious system of partial selections and extra bounties. If 30,000 men should be required to reinforce the Line, there will be no difficulty in finding them, and they will, I feel certain, be obtainable without any bribe whatever. During the Crimean war and Indian mutiny, most Militia regiments (indeed I don't know of any exceptions) volunteered without any inducements being held out to them, for foreign service in the field, and meant it, too; and the same patriotic and martial spirit, rather more intensified, if anything, is alive still, and will at any moment place twice 30,000 Militiamen at the disposal of their country. And if in an emergency the entire Militia force should not be required at once, and selections had to be made, why not make selections which would be provocative of emulation instead of disgust? In such an event, let a dozen of the most efficient regiments be called out in their integrity, Officers and men, just as they are, into active service. Let a Militia regiment be brigaded with a Line regiment, instead of a fragment of a Militia regiment being merged in a Line regiment, and, I venture to say, that the result would be such a spirit of generous rivalry and emulation throughout the whole Militia force as would render extra bounties and inducements altogether unnecessary.

But the desired end will never be attained, let the training be ever so much extended, until the billeting system is abolished. It is doubtless important that a soldier should be well drilled, but it is far more important that he should be well disciplined. Even a Militiaman can see that the internal discipline of a regiment can never be carried out in the drill-field, and that it is within the barrack-walls alone, it can be thoroughly developed and enforced. *Esprit de corps*, regular habits, unquestioning obedience, complete subjection of the individual will, are more indispensable even than drill. A man may manœuvre steadily, and fire straight, and have a stout heart, but if he has not learned the lessons of complete self-abnegation and perfect obedience, he will be at all times, and more especially in the flurry of action, or the demoralizing hour of disaster, a very inefficient and worthless soldier; and it does not require to be a military man to see, that the general adoption of the billeting system would render internal discipline impossible, would disorganize the best trained army in Europe, and convert it into a rabble. If this is the case with the dry tree, what must it be with the green?

How are 100,000 Militiamen, who have been running wild through the length and breadth of the land for eleven months, to be disciplined when they are allowed to run still more wildly for the remaining month,

through the towns in which they are billeted? But this is literally the case; for, practically, a Commanding Officer has no full control over his men once they leave the parade-ground. Pickets and inspections of billets, by Company and Orderly Officers, and all that sort of thing, where they are practicable, can never insure constant supervision of the men; and even these are delusions where men's billets, as is the case in many instances, are three or four miles distant from their head-quarters.

If any one wishes to see the working of the billeting system amongst the Militia, let him take an afternoon walk in any district; let us say, for instance, the metropolis and its environs, when a regiment is out for training, and see the guise in which too many of the constitutional defenders of their country present themselves. I was going to say that they look like the refuse of a disbanded army, but the representation would be far too flattering to them. It would be more correct to say that they resemble a rabble who had lately looted a military baggage train, and decked out in shreds and patches of their plunder were disporting themselves according to their various inclinations. The costermonger of the East, and the donkey boy of the suburb, may be seen pursuing, in full panoply and unrebuked, their several avocations, under the very noses of Adjutants and Commanding Officers. Here a speculative group, civilian from the waist upwards and military from the waist downwards, or *vice versâ*, are occupied in the ennobling pastime of pitch-and-toss; there a free fight between two pairs of regimental trousers, bottle-holder, a full Non-commissioned Officer, in full regimentals and billy-cock hat; further on, an omnibus, crowned with flushed warriors, rather drunk than otherwise, and mostly open as to the tunic, and cotton handkerchief as to the neck. At every corner public-house, a guard of honour hilarious, and for the most part riotous. These can be seen any day, and to say nothing of midnight orgies and the consequent sensation-headings in the public prints of—*Another Militia Outrage—Alarming Disturbance of the Peace by Militiamen, &c., &c.*, ought to afford convincing proof how the billeting system trails the Queen's uniform in the mire, and stigmatizes and degrades the men who wear it.

It is with the soldier as with every other man,—our habits of life are not formed merely by what is learned from books, as a boy, but mainly by the discipline which is undergone, either at home or at school, in early days. It requires no prophet to be able to predict that a boy who is suffered to run wild out of school-hours, will come to grief in after years.

The obvious remedy for this crying evil is the erection of barracks for the Militia; and the obvious objection to the remedy is, that it will cost too much. Well, if that be the case, let only such a proportion of the Militia as can be provided with barracks, not then occupied by regular troops, or who can be brigaded together under canvas during the period of their training, be called out every year.

By that means the nation would have a small number of men worth something, instead of a great number worth nothing at all; and what would be lost in numbers, would be gained in efficiency. I doubt, however, very much if the nation would, in the long run, be at all a loser by the substitution of the barrack for the billet system.

The estimate this year for "allowance in lieu of lodgings, billet money of Officers, Non-commissioned Officers, and men, and hire of barracks"—for the Permanent Staff and Volunteer Militia amounts to £78,300, which, at 4 per cent., represents the interest of nearly £2,000,000, a sum which would go far towards housing the entire Militia Force of the United Kingdom. Indeed a letter has lately appeared in the *Times*, from an Officer commanding a Militia Regiment, stating that "an eminent architect offers to build barracks of a "most excellent and substantial kind for a regiment of 1,050 men, with "Officers' quarters, for a sum not exceeding £14,000." If this estimate is correct, 140 barracks could be provided at the cost of the present billeting system. But 140 barracks would not be required. There are many unoccupied barracks in the United Kingdom that could be turned over to the Militia, and there are many that could be occupied by the Militia during the absence of the regular troops in camps and elsewhere. Then a portion of the Militia might and ought to be brigaded during their trainings in permanent or temporary camps; and again, the trainings of three or four adjacent regiments might be consecutive, and each in their turn occupy the same barracks, which could provide accommodation for the Staffs of all during the intervals between the trainings. "So that I do not think that more than sixty or seventy new barracks would be required, and a considerable margin of the present expenditure of £78,000 be still left for their maintenance and repairs.

But even if barracks be added to extended training. There is still a formidable obstacle (to my mind the most formidable) to Militia efficiency in the way. If other parts of its system require to be reformed, the officering of the Militia requires to be revolutionized, for the mode in which it is conducted, is in every respect as faulty as it well can be, and is of itself sufficient to paralyze all the vital energies of the force. As the first step to its reform, I would wish to see the patronage of the Militia remodelled. At present it is altogether in the hands of the Lords Lieutenant of Counties, and the upholders of the present system will doubtless defend it on the grounds, that as the Militia is a local force, and the Officers, country squires or their sons, who must by law possess a certain property qualification, and whose tenants and dependants fill the ranks, therefore the chief man in each county is obviously the proper person to select the Officers for his County Regiment, and that a departure from this system would, by destroying the local character and clanship of the Militia, thin its ranks, and impair its efficiency. This was the idea no doubt on which the Militia system was originally based, and a very good idea 200 years ago, when, though the sun of chivalry had set, the glow of its parting rays were still felt throughout the land, when feudal traditions and influences were still potent, when most country gentlemen knew more or less of soldiering, when there was no manufacturing or floating population worth talking of, and tenants were more dependent on and attached to their landlords than they are at present. But it is a worn-out, effete, and utterly impracticable idea now-a-days. A Captain of Militia does not now grow his company

on his estate, and bring it with him to the annual trainings; many of the men, in some cases all, are strangers to him, until he meets them on parade, and few and far between, are the faithful clansmen, "who follow to the field their warlike Lord." There is no balloting for recruits now-a-days, and consequently no occasion to make compulsory service palatable to an unwilling recruit, by placing over him men whom he has known and to whom he has been attached all his life. The fact is, that the Militia is altogether recruited by the Adjutant and the Permanent Staff, men who for the most part have no tie or connection whatever with the county in which they are stationed, and who pick up their men by means of the blandishments and allurements, ordinarily had recourse to by recruiting parties for the Line.

Nor are the officers invariably county potentates; some certainly are, and I wish there were more of them, but in many instances Officers of the Militia have no more connection with the locality in which their regiments are trained, than Officers of Line regiments with the localities in which they are quartered. They appear on the first day of training, no one knows whence, and disappear on the last, no one knows whither, and most probably are neither seen nor heard of again until the next annual muster. I do not know how the question of qualification is got over, but it is somehow, for denizens of every quarter of Great Britain may be found sitting at the same mess-table, many of whom are as devoid of any property qualification whatever, as they are of local connection with their regiments; nor are instances wanting in which the Sister Isle supplies Officers to English regiments, not a few of whom, and some of superior rank, are in their own country, officials in professional or public offices with small salaries, and still smaller private means, and who could not possibly afford to retain their commissions, if their regiments were called out for active service. But even this infringement on the principle of local appointments has failed to secure a sufficient complement of officers. For though "the further appointments of Ensigns and Second Lieutenants in Militia regiments have been suspended," there are still in the reduced establishment of Officers nearly 1,000 vacancies, and every day it is becoming more difficult to induce any one to accept a subaltern's commission in the Militia. There are at present actually six regiments who have not a single subaltern amongst them, and twenty-four who have not more than two each.

But if the arguments in favour of the present system are out of date, the objections to it are not. It is manifestly detrimental to its efficiency, that the appointments and promotions of a military force should be altogether in the hands of country gentlemen, for the most part totally innocent of any acquaintance with military affairs. To be merely the nominees of a Lieutenant of a County, is in itself a deterrent to many gentlemen, who would not only willingly accept, but seek a commission, if, as in the Line, it proceeded directly from the Sovereign; and this is one amongst many reasons, why a Militia commission is so little valued, that few officers care to assume the titles of their rank, except during the brief period of training. We are all accustomed to,

and wish to avoid the supercilious elevation of the eyebrow with which Captain So-and-so of the Militia is received by his brethren of the Line. But that is not the worst—the *pitchforking*, which is the necessary consequence of the present system, is still more galling and pernicious. The Lord Lieutenant may virtually appoint or promote just as he pleases without reference to regimental fitness or seniority. The civilian of to-day may, and sometimes is the Colonel Commandant of to-morrow, and grizzled Field Officers of many years' standing touch their caps to, and "Sir" beardless boys just emancipated from school and college—

"That never set a squadron in the field,
Nor the division of a battle know
More than a spinster."

and mushroom commanders of companies are such every-day occurrences, that a covering serjeant would be quite taken aback, if his newly-appointed Captain could face properly on parade without assistance. Within the last few years indeed, a recommendation—it can scarcely be called an order—has been issued, that promotion should go by seniority, except under peculiar circumstances, but the order has been "more honoured in the breach than the observance," and the evil has been but very partially checked. It would be waste of time to comment on the results. They are self-apparent, derision and contempt from without the force, from within, heart-burnings, jealousies, disgust, resignations, and inefficiency. All this might be avoided if the feudal idea was modified so as to suit the requirements of the present day. For it is with the State, by its blind adherence to the feudal idea, and not with the Lieutenants of Counties, that the blame lies. They but administer the system as it has existed and been sanctioned, and indeed encouraged by authority for two centuries; and though their appointments may have been in some cases detrimental to the Militia service, they have hitherto been in accordance with the Militia system. I should be sorry to see the connection between the Militia of a county and its Lieutenant severed, or the local principle of officering abandoned; for though the Militia is not now recruited by its officers, still more cordial and intimate relations are likely to subsist between officers and men, when both are of the same county; and an officer who in his civilian capacity has been looked up to, and respected by the privates of his regiment, has opportunities, if he will but use them, which no stranger could possess of exercising a beneficial influence over their character and conduct whilst under his command. It is because I attach great importance to the maintenance of the local principle, and believe that it would be strengthened and confirmed, if the status of the officers was improved, and appointments and promotions proceeded from a higher source, and were less capricious than at present, that I would strongly urge, that while the nominations to commissions should remain in the hands of Lieutenants of counties, the final appointments and all future promotions should be under the control of the Commander-in-Chief, and that the commissions should be the gift of the Sovereign, and not of a subject; and that pitch-

forking being done away with, every Officer, Squire or not, should begin at the lowest rung of the ladder, and that promotions should be regulated as they are in non-purchase regiments of the Line.

I do not apprehend there would be much difficulty with the Squire in these days, when soldiering is returning to its old rank as a national rather than a professional pursuit, and men of wealth and position through the Volunteer ranks as privates. No man of spirit would object to enter the Militia as an Ensign merely because he happened to be a county magnate. Make the Militia a Service that they can take pride in, and I venture to say there will be no lack of country gentlemen amongst its subalterns. But every man cannot be a Squire, and the Squirearchy is not sufficiently numerous of itself to officer the Militia. To fill the gaps, therefore, it must be supplemented by a class as to whom there would still be a great difficulty, namely, the men of small means who have their way to make in the world, and who cannot afford to fritter away their time in profitless pursuits—such men have at present every reason in the world for avoiding the Militia. It is a source of present expense, and holds out no hopes of advancement for the future. It offers them no opening in life, it is a complete *cul de sac*, and a road that not only leads nowhere, but that diverts the footsteps of many a young man from paths which would lead to profit and honour. For while Volunteer-soldiering is merely the occupation of leisure hours, and has become so blended with his other pursuits as to form part of the daily programme without interfering with the business of a man's life, Militia-soldiering while it lasts, is pure and simple soldiering, out of which all civilian element has been eliminated, and it lasts long enough and is pleasant enough to unsettle many a young mind, and give it a distaste for the sober occupations of its ordinary civilian life. But if by any means the Militia could be made to forward a young man's interests in life, if it could be the stepping stone to a military career, and that a certain number of direct commissions could annually be given amongst those subalterns who do not possess the necessary qualifications for the higher grades; if Militia service could count for something, say two years for one, in the cases of those who pass from it into the Line, then, I think, the difficulty as to Militia subalterns would speedily be got rid of.

Never having been a Linesman I throw out this suggestion with great diffidence, not knowing whether from a military point of view it would be possible, but I trust that some such encouragement may be given to Militia subalterns, for without it I do not see how the gaps in their ranks are to be filled.

But even if the gaps were filled up, and the appointments and promotions all that could be desired, the Officers will still remain a blot on the Militia System, if more attention be not paid to their military education. At present it is lamentably neglected. There is absolutely no provision made for training the Recruit Officer. The Adjutant and permanent staff are barely sufficient to look after the privates, and have as much and indeed more than they can do to get them into presentable trim for the inspection day. The Officers are pretty nearly left to themselves, and may learn their duty as best they can, if they

cannot learn it at all, and the consequence is, that very few of us know more than the alphabet of soldiering, if we even know that. We are not indeed so disgracefully ignorant as we were during the Crimean war, and some little pains are now taken with us, but even now, there may be found Field Officers who read off words of command from cards pinned to their holsters, and Company Officers who are the mouth-pieces of their Covering Sergeants, and there are few, if any of us, except such as have been formerly in the Line, who are competent to take charge of men in the field, or within the barrack walls; in fact, generally speaking, the men know much more than their Officers, while exactly the reverse should be the case, for if the steadiest and best disciplined troops require to be well led, *à fortiori* the Officers of an imperfectly trained force such as the Militia, ought to be men thoroughly well up to their work, and who could command the respect and perfect confidence of their men. A half-trained Militiaman may to a certain extent be serviceable if commanded by a well-trained Officer, but a half-trained Militiaman commanded by an incompetent Officer is worse than useless, and in the Militia, of all Services, lions should not be led by asses. Until the Officer, even better than his men, and at the head of his men, is available for active service at a moment's notice, until in times of emergency and danger, the Militia force can be safely intrusted to Militia Officers, it will be impossible to convert it into an efficient Army of Reserve; for on the first outburst of war men would be separated from their Officers, and drafted by fragments into the regular Army, and the Militia would revert to the ignominious position it occupied during the Crimean war, of being a mere feeder for the Line.

I have a strong impression that the efficient service of the Prussian Landwehr in the late campaign, was mainly attributable to the fact that the men, who after all were but imperfectly trained, were led by Officers who had received a thorough professional education prior to appointment, and who, though totally distinct from, were not one whit less efficient than the Officers of the regular Army; we may thus learn from Prussia how to provide for our first reserve a body of efficient Officers trained in all the duties of the Line. In that country in the Landwehr of the first call, which is in reality what our Militia pretends to be—the support of the Standing Army in case of war—commissions are laid open without distinction of class, and the Officers are a truly national body, but every candidate has to produce before a mixed military and civilian board, certificates of age, means, consent of parents, conduct and attainments, and if these testimonials are satisfactory, to undergo (unless he be a student from the universities or certain royal schools) an examination in German, Latin, French, Mathematics, Geography, History, and the elements of Natural History and Physics. If he passes, he receives a certificate and is posted as a cadet for twelve months to a regiment of the line. During the first six months he serves as a private soldier, and is chiefly occupied with recruit's drill. In the next six months, if perfect in drill and a private's duties, and has passed a practical examination in Surveying and Gymnastics, he receives the grade of Corporal, and is instructed in the

duties of an Officer. Three weeks before the end of the twelve months' service he has to appear before a regimental board, and is tested, first, orally indoors; secondly, in the field; and thirdly, by written papers on all the ordinary duties of a subaltern in field and garrison. Should the result and the Cadet's personal qualifications prove satisfactory to the board, and the other Officers of the battalion, he receives a certificate which entitles him in due time to a commission in the Landwehr battalion of his own district.

From this we may see what importance is attached in Prussia to the professional training of Militia Officers, and the late German war affords proof that the importance has not been overrated.

Though, for obvious reasons, we could not in this country apply so crucial a test, and the elaborate Prussian system of *Einjährige* affords facilities for educating Officers which we do not possess, still I think a modification of the Prussian training might be adapted by us with advantage; and indeed in a very small way, we have already taken a step in that direction. A Militia Officer may now, if he makes application, be attached for one month's training to a regiment of the Line. This is all very well as far as it goes, but it is open to two fatal objections—

1st. The time is too short.

2ndly. The training is purely voluntary.

Nothing can come of a month's training even in the best of schools; and where the voluntary principle is applied to education, I fear the number of scholars will be very limited. Besides which "a little knowledge is a dangerous thing," and the smattering of soldiering thus acquired, not unfrequently turns the recipient's head and makes him intolerably cheeky, and self-sufficient, and insufferable when he joins his comrades of the Militia. To effect any good the professional training must be more thorough, and I would venture to suggest that no nomination for a Militia commission should be confirmed, until the candidate previously approved of by the General of Reserves had as a Cadet gone through a regular course of training with a line regiment for six months at least (I wish it could be for twelve), and at the end of that period had obtained a certificate of efficiency after a searching examination by a military board.

If the commissions were made contingent on the certificate, sham Officers would become an impossibility, the chaff would be sifted from the wheat. We who hold our commissions, though we think them a bore, because Lord So-and-so pressed them upon us, or because there was always a Major or a Captain in our family, or on account of the uniform, or because we like the fun of playing at soldiers for a month every year, should disappear, and our places be filled by working men, well up to their work. It may be that our places would not be easily filled, that the test is too severe, and that the asterisks in the "Army List" would be increased instead of diminished, but even if it were so, and that the gaps were multiplied tenfold, I would still be an advocate for thorough professional training. A battalion with but three zealous Officers who knew their work, would, I venture to assert, be more efficient than one with a full complement of such Officers as we

have under the present wretched system. I do not, however, anticipate that there would be any falling off. Let the Militia be once made a SERVICE, and it will be found that there are still enough spirited gentlemen left in old England to officer her First Reserve, notwithstanding the preliminary discouragement of professional training.

I have not been able to ascertain with precision the annual average of Militia appointments, and therefore the expense of the professional training scheme suggested must be in a great degree a matter of conjecture, but I do not think that in one year there would ever be more than 200 candidates for Militia commissions, and if each cadet during his probationary course received the allowance of 5s. per diem now given to Militia officers while attached to the Line, the total annual cost would be something under £10,000; to my thinking not too high a price to pay for obtaining efficiency in the officers of a First Reserve.

In these remarks I have confined myself altogether to the consideration of the possibility of converting our present Militia into an efficient Reserve. I do not feel myself competent, nor will I venture to enter into the general question of Army Reserves, but I trust I may not be considered presumptuous if, as an outsider, I express a hope that the services of those men who leave the regular Army in the prime of life may in some way be secured for the Militia. It is lamentable to see 4,000 or 5,000 as fine men as ever stepped, lost annually to the country, who, if diffused through the Militia, would leaven the whole mass with the leaven of true soldiering; and if it were practicable that every soldier who re-engaged to complete, say 25 years, was bound to serve 15 years in the Line and the remaining ten in the Militia of the district to which he originally belonged, a most valuable infusion of seasoned soldiers in the full vigour of manhood would be secured for every Militia regiment in the United Kingdom.

Now, with respect to the whole subject, I am very sensible that the crude suggestions I have ventured to offer are open to many objections, but even if they were unimpeachable in other respects, I feel that they, or any other scheme by which the estimates would be increased, will be met by an objection which, for some time at least, will be a lion in the path, and which can be summarised in one word—Abyssinia. But this is an objection which applies with equal force to the Militia, as at present constituted, and the same prudential reasoning which would deter us from making the Militia efficient should also prevent us from throwing away a million annually on a perfectly useless force. It may indeed be said that though worthless as a military force, it still has its use as a nursery for the Line. On that point I will merely observe that the estimates for the Militia this year amount to £986,762, and the total charge for direct recruiting for the Line to £103,258, that the number of recruits finally approved for the Army during the years 1863, 64, and 65 was 42,457, giving a yearly average of 14,200 recruits, of whom more than four-fifths were obtained by direct recruiting, indeed in the six months from July to December, 1859, out of the exceptionally large number of 14,000 recruits finally approved, but 1,002 were enlisted through the agency of the Militia, so that if 10,000 recruits obtained

direct by the Line cost but £103,258, while 1,000 or 3,000, or 4,000 recruited by the Militia cost £986,762, or even if the Militia recruited man for man with the Line, it can scarcely be considered an economical or satisfactory nursery for the regular Army, and it appears to me that there are but two courses left for us to adopt with respect to it, either to make it efficient or to abolish it altogether. Either alternative is preferable to the perpetuation of the present costly delusion; but the first will, if I mistake not, be found in the long run to be the better and the cheaper of the two, for that ugly problem, how with 10,000 men to meet him that cometh against us with 20,000 men, still stares us in the face, and sooner or later we shall have to deal with it, either by making the Militia more efficient as a Reserve, or by a material increase of the standing Army. I can see no middle course, for if the Militia do not furnish a very considerable portion of the materials for a Reserve, I do not see where sufficient materials are to be found elsewhere.

There is no one who estimates the value of the Volunteer force more highly than I do. I look upon the Free Lances of England as a tower of strength to the country, and though they have completely taken the wind out of our sails, I do not grudge them in the least their well-merited popularity. But they can never form a *First Reserve*.

The functions of a *First Reserve* are, in time of war, to release the regular forces from garrison duty at home and in the colonies, and to take the field whenever and wherever it may be called upon, and these are functions which the Volunteers are unfitted to discharge except for a spurt with an enemy at our very gates. Then, the Army of Reserve Force, as constituted under the warrant of 1859, has been a complete and admitted failure, and the pensioners are, for the most part, stale and numerically insignificant, and if the nation will not utilize the materials for a Reserve which they possess in the Militia, and is still bent on solving the ugly problem, I see nothing for it but a large increase to the standing Army. In a word, we have three courses to pursue, to make the Militia an efficient First Reserve at a moderate expense; to increase the standing Army at an immoderate expense; or to abolish the Militia, save the money it costs, and trust the future of the British Empire to the mercy of events, and to the forbearance of the great Powers of Europe.

Evening Meeting.

Monday, January 18, 1869.

REAR-ADMIRAL ERASMUS OMMANNEY, C.B., F.R.S., in the Chair.

NAMES of MEMBERS who joined the Institution between the 1st and 18th January, 1869.

ANNUAL.

Clutterbuck, Thos. St. Quintin, Lieut.	Schomberg, G. A., C.B., Col. Com. Roy.
29th Punjab Infantry. 1l.	Marine Art. 1l.
Sullivan, T. D., Lieut. late 56th Regt. 1l.	McMahon, C. J., Capt. Roy. Art. 1l.
Hanson, Joseph, Ens. late 1st Surrey	Turnbull, H. C. M., Lt. 6th Roy. Regt. 1l.
Rifle Volunteers. 1l.	Nicolson, Frederick, Lieut. Roy. Art. 1l.

INGLEFIELD'S NEW HYDRAULIC STEERING APPARATUS, AS BEING FITTED TO H.M.S. "ACHILLES."

By Captain E. A. INGLEFIELD, R.N., F.R.S.

ONE of the leading Naval journals in commenting upon my hydraulic steering apparatus, which is now ordered to be fitted on board Her Majesty's ship "Achilles," made the following remarks, and I think them so much to the point that I shall take the liberty of quoting them:—

"In all fighting ships there is one especially weak point which, if successfully assailed by the enemy, at once places the vessel *hors de combat*, and leaves her entirely at the mercy of the enemy. This point is the steering apparatus, the destruction of which leaves the ship a useless log upon the water, unable even to run away, unless Providence had previously placed her head in such a position as might admit of such a manœuvre being possible. No matter what may be the perfection of every other part of the ship, no matter though her battery be impregnable and armed with irresistible weapons, all can be rendered absolutely useless by one well-directed blow at the steering apparatus, which in all vessels, whether old-fashioned or new, is more or less exposed. Not only is the apparatus exposed, but the men at the wheel, put there where you will, are liable to be swept away, and the ship at a critical moment left helpless, either before an evil-disposed enemy, or in the vortex of a storm."

To Naval Officers this must have been an oft-recurring thought, and it is to overcome this serious weakness in our fighting vessels that a process of hydraulic steering-gear has been proposed and experimented upon in various vessels of Her Majesty's service, and in some few of the large passenger steamers.

A slight description of those forms of hydraulic steerage which have been tried, but which have failed to comply with all the conditions expected in a perfect form of such apparatus, will perhaps be the best introduction to the subject I have now the honour to bring before the members of this Institution.

In all descriptions of hydraulic steering apparatus, the motor power has been invariably steam—a steam-engine generally placed in the engine-room to work pumps which were to supply the hydraulic cylinders.

In the drawing now before you is shewn the usual process by which the power was applied; in some cases a short back-action tiller has been employed, whilst in others, according to convenience and space, a tiller shipped in the usual manner, but of much smaller dimensions.

In the "Warrior," which was one of the first of Her Majesty's ships fitted with an hydraulic steering gear, a back-action tiller was fitted, and the pressure cylinders were laid on suitable beds in the Captain's after-cabin; the short tiller was moved by the piston rods of the hydraulic press, and these were set in motion by means of pipes which were led from the pumping engine to the pressure cylinders.

It was found, however, that there was a want of uniformity in the action; that, for example, the engine was not always ready, as steam was not always up, and unless kept constantly in motion—pumping water to waste,—there was a condensation in the cylinders of the pumping-engine which prevented immediate action.

To remedy this defect it was suggested to fit an accumulator such as are supplied for hydraulic lifts, and as in the case of the new Birkenhead Docks, to open and close the gates.

Two accumulators were supplied to the "Warrior," and these cumbrous machines made to contain water were placed in the bread-room, and heavy weights,—upwards of five tons each,—on movable pistons, imparted the velocity to the column of water, and which was nearly equivalent to the pressure when pumped by the engine.

The accumulators were kept charged by the pumping-engine, and were thus always ready for use, and certain in action.

In the trial trip with this apparatus, I am told the action was satisfactory, but there was a steam-engine required, and constant attention necessary as to the condition of the contents of the accumulators; it required also the continual presence of an engineer or a leading stoker to start and stop the pumping-engine.

Whether these were the objections which caused the Admiralty to reject this form of hydraulic steering apparatus I am not aware: suffice it to say that shortly afterwards, the hydraulic steering apparatus was taken out of the "Warrior," and for a time the subject was neglected, at least in the Navy.

The well-known engineers, Messrs. Humphreys and Co., however prevailed upon the Admiralty to try their patented process for hydraulic steering, and accordingly the "Minotaur" was fitted by them, and all that good workmanship and scientific skill could render

to make success certain was brought into play; still the steam pumping-engine was a part of their plan, and constancy in action was obtained by keeping the pumps continually at work—but to waste—awaiting the moment when the long lever worked by two men on the upper or main deck opened the communicating valve to the pressure cylinder, which in this case was single, with a pull and thrust motion on the short tiller.

Having been ordered by the Admiralty so far back as 1865 to send in estimates and plans for fitting the "Warrior" on my principle, I happened to be at Portsmouth taking measurements on board that ship at the moment the "Minotaur" arrived at that port from her first trial trip, and, going on board, I enquired of the officers and quarter-masters if the working of this new steering gear was satisfactory; they replied that it required at least two men to move it, and did not work instantaneously enough, but that when it did start it was very powerful in its action, but not easily controlled.

Now I know not whether these difficulties could not have been overcome, but the principle remains the same, the steam-engine motor and the cumbersome nature of the machine and lever requisite to set it in motion.

In the notice in the "Times" of Saturday, Sept. 9th, 1865, regarding this apparatus, it was remarked that, "so far as those results went, they not only gave a great inferiority to what was obtained from the ordinary steering-wheel, but they were infinitely inferior in every respect, the most forcible illustration of which was, the utter absence of controlling power in giving or checking the force from the ram piston to the rudder-head. Hydraulic steering of ships will be a grand innovation upon the old-fashioned wheel, rope, and tiller system, if in the former system it can be as evenly applied and checked as in the latter."

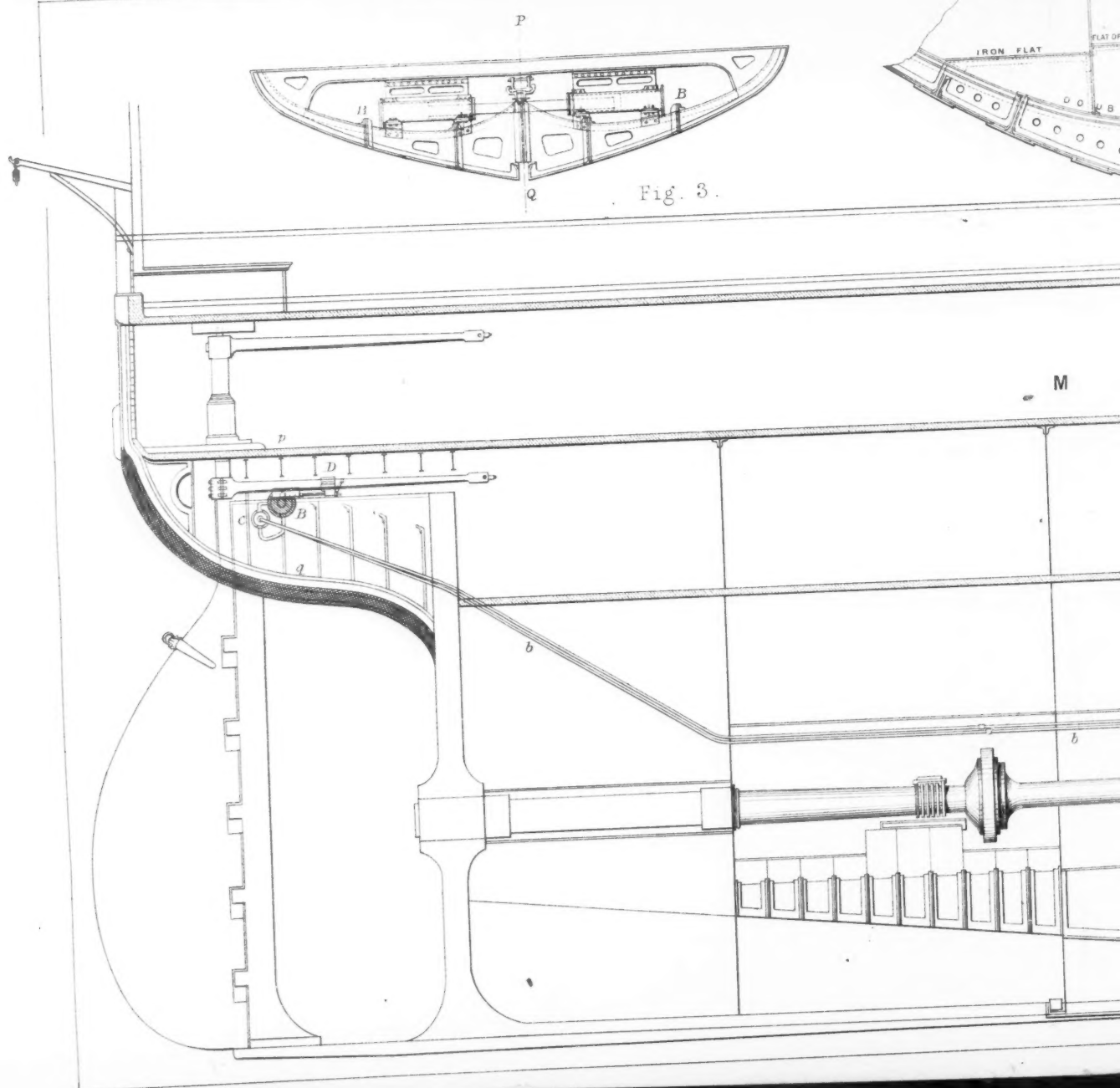
There is still another kind of steering gear which has been lately tried with very marked success as regards power and facility of control. I allude to one which has been lately fitted in H.M.S. "Northumberland." This, I am informed, consists of a steam-engine which is employed to move a barrel on which the usual tiller ropes are wound; but here is still the steam-engine, and, added to that, the long tiller and the ropes.

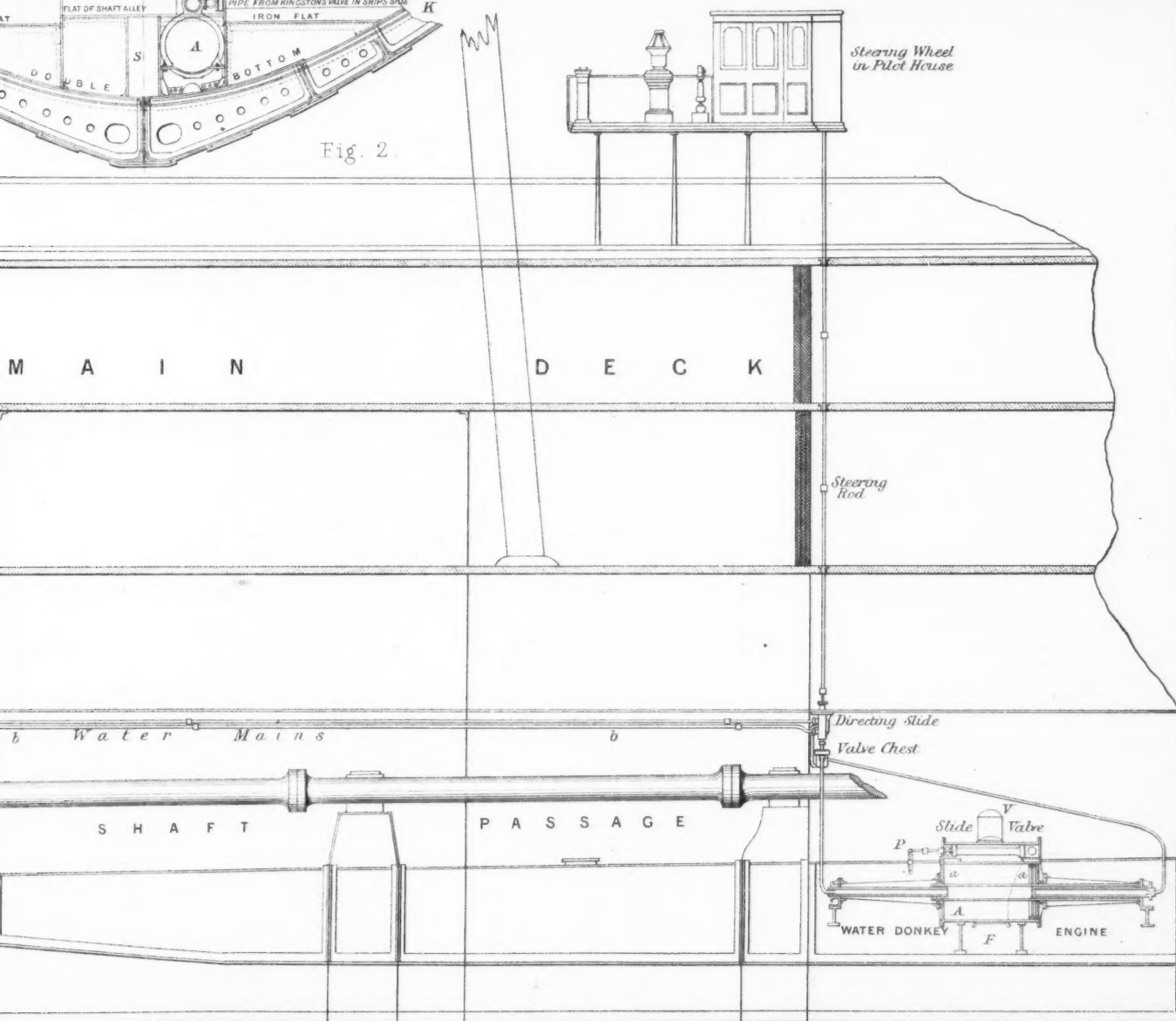
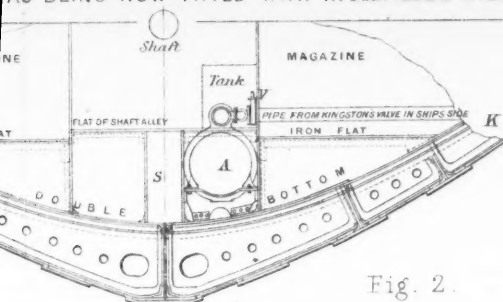
In the form of hydraulic steering gear which I have invented, and which I propose to distinguish from those I have described by the term *hydrostatic* hydraulic, in contradistinction to the *steam* hydraulic, the motive power is that which exists in every ship, under all conditions when afloat, and variable in force only as the draught of water of each vessel.

It will be understood from the foregoing that I allude to the pressure of water at the bottom of the ship, and I look upon and treat this pressure just as a vast and inexhaustible accumulator.

It is clear that this pressure (which is measured as an ordinary column of water), roughly estimated at $\frac{1}{2}$ lb. per square inch per foot of draught, would be equal to about 10 lbs. in a ship drawing 24 feet of water. I say only 10 lbs., as the water admitted through a Kingston

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valve could only be made available at a depth of about 20 feet in the hold of the ship. K, Fig. 2, plate I.

Now I employ this power to work a pump of a peculiar character.

In the drawing before you may be seen the pumping cylinder, which lies on the keel of the ship, and on one side of the strong back. AA, figs. 1 and 2.

The internal economy of this cylinder may be thus briefly described:—

Its piston rods are fixed and hollow, and are in direct communication with the wrought iron pipes which lead to the tiller cylinders at the tiller-head.

Now, I cause the action of the piston, which is moved backwards and forwards in the cylinder, by changing the direction of the exterior column of water, coloured green (*a*, Fig. 1), admitted through a Kingston valve, to force the column of constant water, which I have coloured pink (*b*, *b*, *b*, Fig. 1), to the starboard or port-tiller cylinder (B, Figs. 1 and 3), and thus to act on the rods connected to the short tiller; or, as in the "Achilles," to a carriage placed at a short radius on the lower tiller.

Now, the power thus concentrated at this point is for a 2 foot 6 in. radius, equal to about 60 tons—a huge force, only required when the ship is going at a great velocity through the water, and therefore it might be considered—and fairly—a great waste of power when proceeding at a slow speed.

I meet this objection, however, by a simple arrangement of two three-way cocks on branch pipes to the tiller cylinders (C, Fig. 1). By this plan I adapt the power to be exercised according to the speed, to do one or two-thirds of the work in the tiller cylinders, and by a single lever on a dial plate, the quartermaster is able to adjust this power for a 5, 10, or 15-knot speed.

The water which entered the power-cylinder at a pressure, having done its work, must be disposed of. To do this, I have a jacket enclosing the eduction valve, and which coming over the side of the cylinder, not only forms a ready channel for its egress into the bilges of the ship, but also acts in some measure as a syphon, thus drawing off the dead water from the emptying sides of the piston, or end of the cylinder. The bilge-pumps carry off this waste water, but, if preferred, a common lift pump, worked by an eccentric on the screw-shaft, will keep this waste water constantly pumped out.

To estimate the quantity of water thus admitted, I have made the following comparative calculation. The "Warrior," when steaming at the rate of 14 knots, admits on an average about 36 tons, or 720 cwt. of sea water per minute into her condensers. This implies of course that the same amount of water, less the feed, has to be pumped out again by the engine which it has assisted. Now, if it were required to put the helm of the "Warrior" down four times in the hour, there would be expended for my hydraulic-power-cylinder 44 cwt. once in 15 minutes, or at the rate of 3 cwt. per minute constantly. The ratio is, therefore, 240 to 1; that is, 240 times the quantity of water is admitted into the condensers, that would be

admitted into the hydraulic ; this, if thought safer, could, after use, be retained in a closed tank, which might thus correspond so far with the condensers, and from thence be either withdrawn by the bilge-pump, or, by what I at first proposed, a common plunger-pump, worked by an eccentric fitted in a convenient position on the screw-shaft.

I have thus estimated roughly the quantity of water employed in the service of steering the ship at *full speed*. I have here a drawing of full dimensions of the three-way cock, which has been constructed by my ingenious friend Mr. Renton, an engineer to whom I am indebted for much that is novel in carrying out my plans. This three-way cock, which I have before alluded to, is situated in a convenient position, so as to be easily accessible to the quartermaster, and by its use a great saving is effected at slow speeds of the power I *must* employ at full speeds to ensure rapidity of action. But even this I have modified, for it occurred to me that,—as every seaman must have witnessed,—in righting the helm, no manual labour is required, but that the action of the passing column of water upon the surface-area of the rudder exerting a great force, the controlling power has only to be released, and the helm will right itself ; so I would make a similar arrangement to economise power in this plan, and to meet this, a slide of a peculiar kind has been constructed, which, at the middle point of its motion, opens a free passage through itself between the two directing tubes.

By this method, nearly one-half of the original quantity of which I first spoke is saved under all conditions of steerage ; and again, more than another third of the remaining quantity, taking a long average, through the economising process brought into action by the three-way cock.

To form some conception of the force necessary to be exerted at the short tiller used for steering by hydraulic power, I may say that the pressure necessary to be exerted to put the helm over in a minute is about 50 tons ; and this after allowing 25 per cent. for friction.

In the “Achilles,” the arrangement of the beams and strengthening carlins obliges me to take a longer radius than was proposed for the “Warrior ;” consequently the pressure in the tiller cylinders will not be more than about 35 tons, and the length of the stroke under 5 feet.

It will naturally be asked by naval men—how do you propose to steer, should the hydraulic be disabled ? My reply is, that the original tiller existing still *in situ*, the tackles may be shackled, and steering resumed as before, by the wheel and ropes.

The gear I employ to connect and disconnect the hydraulic is shown in this sketch (D, Fig. 1) and may be described as a movable fork sliding by means of a coarse-threaded screw upon the tiller to grasp a pin, and this being placed on the underside of the tiller no derangement would be likely to ensue should the ship strike her rudder on the ground, for the tiller would then be lifted up clear of the fork.

In summarizing the foregoing, I desire to say that the advantages I claim for my system are as follows :—

Firstly, the employment of the vast accumulation of the exterior fluid pressing against the ship's bottom to work an engine which shall convey a power upon hydraulic principle to the tiller head.

Secondly. As this accumulator power always exists under all possible conditions of a ship afloat, and is constant and regular in its action, I can avail myself of it at any moment in large or small quantities, with *certainty* of immediate action, however long it may have been unemployed. This is what I claim as the great advantage over a steam-engine, which naturally can only be brought into play when the steam is up, and as in the "Minotaur" must be kept pumping in water to waste, that it may be ready when required for use. The engine-room space occupied by this "*steam-pumping engine*" is moreover saved by the employment of my *water-pumping engine*, as I place the latter on the keel of the ship, in a spot wholly unemployed and unadapted for any other purpose.

Lastly, the incompressibility and incondensibility of water compared with steam is another feature to my mind of no small importance in its application to the purposes proposed.

It has been suggested that a seaman accustomed to steering a vessel by the ordinary wheel might be at a loss how to manipulate the steering gear of the hydraulic apparatus. I have therefore arranged a small wheel which is made to act on the valve rod by a simple mechanical movement. This wheel, placed in the pilot house on the bridge or rifle tower, the steersman only requires to move a few spokes either way in order to shift the helm; and on putting the centre spoke amidships, the helm is righted by the self-acting process I have before described. By a bell crank action, I propose that the slide rod may be moved at other parts of the ship, and I have proposed that a small indicator, which is moved by an endless chain passing round the rudder head, and a wheel of corresponding dimensions should be placed immediately under the eye of the man at the helm.

As a contrast between the physical power employed in putting the helm hard over when the ship is going 14 knots, if steered with the ordinary wheel and tiller ropes, I may instance, that in the "Prince Consort," it required eight men crowded into the wheel, and twenty-eight at the relieving tackles in my cabin to get the tiller over in a minute and a half; whilst in the form of steering gear, I have now proposed, no more force is necessary than can be *readily applied by a boy*.

If I have failed in making myself quite intelligible with regard to the various parts and working of my engine, I shall now be happy to reply to any questions, and shall be very glad to have the opinion of Naval Officers upon the subject.

The CHAIRMAN: We have had a very clear description given of this steering apparatus, and I invite gentlemen to discuss the subject, or to offer any observations.

Captain HORTON, R.N.: I should like Captain Inglefield to explain whether there is any other way of moving the helm besides the little wheel that he has described?

Captain INGLEFIELD: That will be the only means of steering a wheel two feet in diameter.

General BOILEAU, F.R.S.: I think you said the length of the stroke of the cylinder was five feet?

Captain INGLEFIELD: Of the tiller cylinder.

Major-General BOILEAU: Might I ask if that would be sufficient to put the helm hard over?

Captain INGLEFIELD: Yes; it is calculated to put the helm against the cabin bulkhead. I may add that the principal advantage of the plan I propose is, entirely to dispense with the steering wheel, where usually a number of men are placed. It would do away with the wheel, ropes, and the 15-foot tiller.

Lieutenant A. GILMORE, R.N.: I may remark that by your method you release one gun's crew.

Captain INGLEFIELD: A whole gun's crew at least; and, moreover, the men are placed in safety.

Navigating-Lieutenant J. RICHARDS, R.N.: I should like to ask what arrangement Captain Inglefield proposes, when the helm is moved amidships, to prevent it flying over to the other side if the ship is rolling? because in the ordinary tiller the opposite ropes have a checking power. What is proposed to retain the helm amidships, because when it is relieved it will fly over to the other side?

Captain INGLEFIELD: Not if the ship is going through the water. If the ship is going fourteen knots an hour, the helm will remain amidships; but the man has an indicator before him, and the instant the helm is righted, he can lock it, by putting the slide in such a position that the water cannot move in either of the tiller cylinders. Perhaps it will be better to explain that when the ship is going to sea the only process necessary is to open the Kingston valve, the Kingston valve being open, the sea then has free access to the pumping engine, but nothing is done until the rod admits the water into one or other of the tiller cylinders, and the moment the water has been checked from going into one of those pipes, that moment all action ceases. The man might leave the wheel and go away; the water is locked in the tiller cylinders, the pumping-engine can neither work, nor can alteration take place in the water which exists in the two tiller cylinders; the engine stops immediately, because there is nothing for it to do.

Lieutenant RICHARDS: That does not appear to me to check the play of the rudder instantly?

Captain INGLEFIELD: Yes, the moment the water is locked up in the two tiller cylinders it is impossible for the rudder to move. Water is an incompressible fluid. It is positively locked into the two tiller cylinders, and the helm is even more rigid than it could ever have been with ropes.

Lieutenant GILMORE: For the rudder to move it must burst the cylinders?

General BOILEAU: They form, as it were, incompressible buffers?

Captain INGLEFIELD: Exactly so. There is an advantage which I consider water has over all other things. In the "Northumberland apparatus," steam was used to move the tiller ropes, but the power was so enormous that in the case of the "Great Eastern," where it also was used, the chains were carried away; the chains were rendered almost too rigid by this immense power. The inventor, therefore, prefers using a strong rope.

The CHAIRMAN: What is the position of the bridge in your plan?

Captain INGLEFIELD: I have made these drawings from the ordinary Admiralty drawings. Here is the pilot-house, where the Captain stands. My arrangement brings this rod inside the armour plate. The "Achilles" is armour-plated only as high as the main deck, then there is a belt all round the ship enclosing the battery. This rod is brought up just inside that belt; the armour plating protects the whole of my apparatus.

Captain HORTON: What would be the effect were the pilot-house shot away?

Captain INGLEFIELD: I propose that there should be several other means of moving the rod. On the main, upper, or lower deck you may have similar wheels: any motion that will move it up and down six inches will do. I have also suggested that it should be carried, by means of a bell crank lever, to the other end of the bridge, so that the Officer of the watch may put his hand upon the lever, and, without calling the Quartermaster, put the helm down himself; a bell crank lever will move the rod up and down six inches.

Lieutenant GILMORE: Would that do?

Captain INGLEFIELD: Yes, because I propose that the action of one should cor-

respond with the action of the other. The chances are that the helm would be amidships, and then it would be locked, and the Captain could move it independently.

Lieutenant GILMORE: Would your plan be applicable to the ordinary wheels we have now, one on each deck—the fighting wheels?

Captain INGLEDIE: Certainly.

Lieutenant RICHARDS: How do you propose to get rid of the waste water, if the apparatus is used whilst the ship is under sail?

Captain INGLEDIE: That is one of the conditions that has not been generally entered into, because steering by an apparatus of this sort has not hitherto been applied. It is presumed that the ship is going into action or manœuvring, and that the steam is up, as is the case in all men-of-war. I have considered that question apart from this process of mine. I propose that in all steamers, abaft the disconnecting gear, should be fitted an eccentric to work a plunger pump. There would be this double advantage. When the screw is disconnected, the ship going from four to six knots, the screw will generally revolve. Now, if the ship is disabled and so much water is made as to put the fires out, by disconnecting, the screw revolving as she goes through the water would pump the ship out; and that would apply to ships sailing as well as to ships in distress when the fires were put out by water in the hold. In the "Prince Consort" the screw would always move when disconnected, the ship going about five knots. Of course the immense power required to move a screw of those dimensions would have been abundantly enough to pump the ship out; therefore, if you were sailing, with the screw disconnected, the same action would take place. But supposing no such means were available, then I have calculated that the water admitted in twenty-four hours under ordinary sailing at sea would be no more than the quantity of water which it is usual to admit into a ship every day for the purpose of keeping the bilges clean, and which is pumped out by hand. In the "Prince Consort" we used to let in every morning—the engineer did it as a matter of cleanliness—a certain amount of water, which, running into the bilges, was pumped out again to sweeten the hold. The quantity of water that would be admitted into a ship according to my plan, merely for steering, would be no more than is let in every twenty-four hours for sweetening the bilges under ordinary circumstances. Of course the plan I propose is a fighting plan, which, with men-of-war now-a-days, is the constant condition in which they move. We found with a cruising squadron that very few ships could tack or do anything with the screw fixed, unless the wind was very strong.

Major BAILLIE, Bengal Staff Corps: I should like to ask some questions with respect to the pumping apparatus. Is there any provision for reciprocating motion?

Captain INGLEDIE: Yes; as an engineer would explain it, the ordinary poppet motion is used here (P, Fig. 1). It is well understood by engineers; though it is not shown in this drawing.

Major BAILLIE: May I ask the diameter of that piston?

Captain INGLEDIE: 36 inches. There happens to be a space which I measured in the hold of the "Achilles," just under the magazine, exactly fitted for the purpose. I thought this strong back (S, Fig. 2) might be in the way, but I found that the piston would drop exactly beside it. Over it is a valve (V, Figs. 1 and 2) which communicates with the Kingston valve through a slide. I know one objection may be raised as to foul water getting in, whether it would not interfere with the fine working of an hydraulic machine. But to get over that, a Kingston valve of the ordinary dimensions (about 12 inches), is used; but the aperture through which the water gets to it will be a double area, flush with the side of the ship; and that will have a coarse sieve fixed on it, so as to prevent seaweed and other things getting in. Here (V, Fig. 2) I propose another slide which will be capable of being taken off and cleaned when the ship is in port, so that it will be impossible for any dirt to get in. The water which passes into the tiller cylinder is a constant quantity, not a variable quantity, like that which is admitted for pumping purposes, and which afterwards passes into the bilge.

Major BAILLIE: I think you said the water, after it passes into the cylinder is discharged into the bilge. Can it be discharged anywhere else?

Captain INGLEDIE: It must be discharged there.

Major BAILLIE: Is not the pump there higher than the sea outside?

Captain INGLEDIE: No, it is inside.

Major BAILLIE: I am speaking of where the water acts upon the tiller.

Captain INGLEDIE: There is no discharge there. I was just saying that that is constant water, only changed by the action of the pump here, A, Fig 1. The water that comes in with the power is changeable water; and after having exerted itself with its power it is useless, and falls into the bilge. The chief engineer of the "Achilles" suggested that it should be allowed to fall in here, F, Fig. 1, where it immediately gets into the bilges under the engine-room, and is taken out by the bilge-pumps.

The CHAIRMAN: The subject brought before us is one of very great interest in the present day. As far as I can see, it is a most useful and most desirable application. It appears to be perfectly safe from the shot of the enemy, and, from what I gather, it appears to be easily under control. On both these grounds it appears a very desirable application for our men-of-war. I think the meeting must congratulate Captain Ingledie on having shown so much engineering knowledge on this subject, and wish him all the success that he deserves. I am sure that you will join me in thanking him for his very interesting paper.

EXPANDING-SHOT-PLUG.

By Lieutenant ARTHUR H. GILMORE, R.N.*

In submitting to your notice several of my inventions, I fear that instead of my finding safety in their numbers, you may find tediousness.

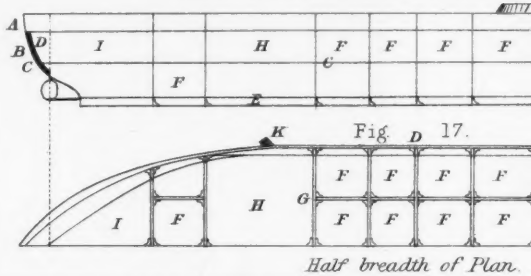
My excuse must, however, be that I think their adoption will be of benefit to the Service, and therefore to the country.

Inventing is not a lucrative business, as I know, to my cost; still the brain having brought forth an idea, we take it to our heart as the child of our mind's creation, and make much of it. Everybody thinks his own crow the blackest, and I suppose it is the same with inventors. At any rate, I think that no harm can accrue from trying these inventions of mine. It is a great boon to the Officers of both Services that we possess a place like this Institution, where we can come and disburden ourselves; in some cases, "a mouse may be the result of our labours;" but still here is an arena to which we can come, and having explained our plans, can listen to suggestions from, and enter into discussions with friends who have an equal share of zeal with ourselves for the good of the country.

I will first introduce to you my oldest friend, "An expanding-shot-plug." (Plate II, Figs. 1, 2, 3.) It is a friend of many years' standing, as I invented it when a midshipman in China. I have altered it since by giving it a sheath to protect it when being driven out through a jagged shot-hole in an iron ship.

* Now Commander Gilmore, R.N.—ED.

Fig. 16.
SHEER DRAWING OF AN ANTI-TORPED



SHOT-HOLE-STOPPER APPLIE

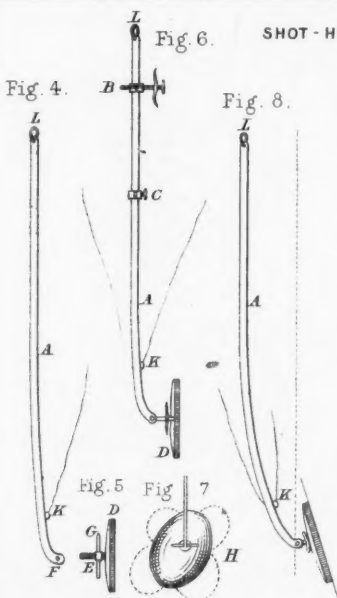
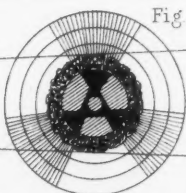
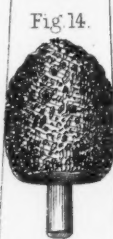


Fig. 1

Engine Ro

Shot hole

EXPANDING SPONGE
Scale 23 of an. Inch to a Foot.

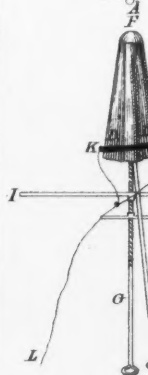


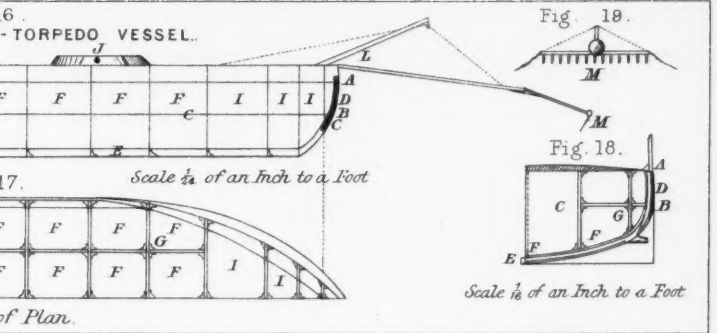
1 Sponge unexpanded
2 Spnge with Staff home
and expanded.



Spiral spring up to 40 lbs pressure
& Gong which strikes when 40 lbs
pressure is put on sponge.

Fig. 1





R APPLIED FROM OUTSIDE AND VARIOUS FITTINGS.

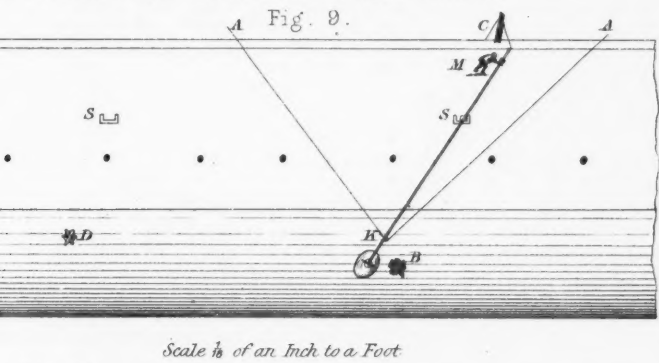
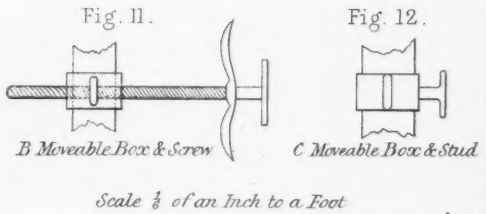
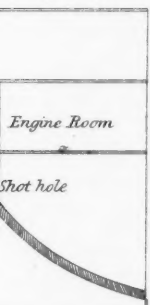
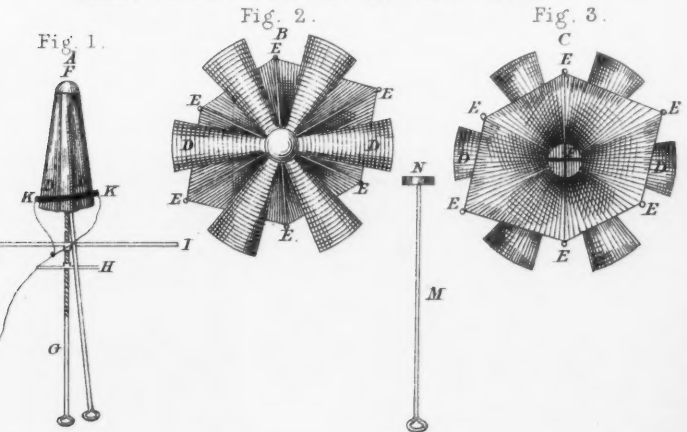


Fig. 10.



EXPANDING SHOT - PLUG APPLIED FROM INSIDE.



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It is, in fact, an umbrella, except that the ribs radiate from the centre until they are at right angles with the rod; the shoulders surrounding the head of the plug prevent the arms going beyond the right angle. The covering and lining of the plug would be coated with oakum, and smothered with tallow and white-lead, in order to make them water-tight. The way to use the plug is this: force it through the shot-hole until the arms are clear of the outside, then slip the confining ring off, and bearing out on the thrusting rod, pull in on the handle, thus expanding the arms; you then turn away on the fly-nut of the screw, which, coming against the bar, which forms a bearing, the arms are hove taut against the ship's side, and the hole is stopped. I may here mention rather a curious coincidence, viz., that when I last lectured here, it was up a my "electric ship-steering-telegraph;" on that occasion Captain M'Killop gave an explanation of his plan for a portable "coffer dam" for stopping holes and leaks; this evening Captain Inglefield, whom I must look upon as a successful rival (for although my telegraph was adopted and several ships fitted with it, amongst others the Royal Yacht which brought the Princess of Wales over when she came to be married, still the instruments—why, I do not know—were considered too delicate); to-night Captain Inglefield lectures upon his invention for steering ships, a plan which has been adopted, and I explain my method of stopping holes, which I hope to see adopted. The expanding plug is for stopping *from the inside* any hole up to 3 feet in length by 2 feet 6 inches in breadth; you will see that the arms are of irregular lengths, so as to adapt the plug to the hole, putting the greater length of plug over the greatest diameter of hole.

I will now explain my method of stopping holes from *the outside*. (Plate II, Figs. 4—12). There is an old saying that the first blow is *half the battle*. Now, in case of a monster shot penetrating a ship below the water line, the first blow would be *all the battle*, unless we have the means (and we have not) of stopping that hole speedily and well. I feel convinced that this plug of mine will do it, whether the hole be between wind and water, or feet below the water line, for some of the new ships do roll pretty heavily. I have been asked the question, "How shall I find the hole if it is a long way down?" Well, if a ship rolls sufficiently deep to expose herself to penetration in the bottom, next time she rolls she will show us the hole, and we shall know where to apply the stopper; should she be obstinate, and refuse to roll to the same extent again, still, knowing by the concussion whereabouts the shot struck, we should feel about with an instrument called a groper, and hold on to the hole until we have the stopper over it. At intervals along the side I have sockets fixed. (Fig. 9). The stopper consists, as you see, of a steel rod, having on it a travelling stud plate, with jamb-nut, and a top travelling plate with a screw working in a female screw in it, having on its inner end a plate to bear against the side. (Figs. 6, 9, 11, 12.) At the lower end of the rod is an oval plate (Fig. 7), concave in the centre, faced with gutta-percha; in the middle of this plate is a central pin, connected with the rod by what is called a Dutch joint. The mode of

application is as follows:—Having taken the rod to the socket nearest the hole, it is lowered to the required depth, and kept in its place by guys worked from inboard, the stud revolving in the socket; the stopper being in its place, the screw is set to work and the hole is covered; if the hole is on the turn of, or under the bilge, the Dutch joint comes into play; as the screw is hove on, it pushes the rod outwards and downwards, the pin pressing the plate down, and you will see that as I heave, the plate turns in until the whole face has a bearing on the ship's side. (Fig. 9.) People say, "Oh, but whilst you are fixing this, the men applying it will be shot;" perhaps so, but war is not a game played with squirts and rose-water, it is a game in which men must expect killing, or being killed, to form part. I would protect the men by using mantelets, and hide them by burning a smoke-ball while they were at work.

Supposing the shot hole to be a very large one, with a crack radiating from it, I have a sort of spring mattress, about 1 foot thick, with springs about it, and well-backed. That will be put inside this plug to cover the radiating crack.

EXPANDING SPONGE.

I will explain to non-professional people, that after a gun has been fired, particles of the cartridge are sometimes left in the gun in a state of ignition; if the gun is reloaded whilst these fragments are on fire, the charge will explode and kill the loaders. The use of the sponge is to extinguish these sparks. We all know that fire will die out unless it has its proper feed of oxygen procured from the air. By forcing the sponge home to the bottom of the bore, and pressing it there, the sparks will be extinguished. In my sponge you will see that the core is divided into three parts and hollowed into a wedge in the centre (Fig. 13); the three parts are kept together by elastic bands; the end of the staff forms the male wedge, and it is kept in its place by means of a pin working in a slot, the woollen covering is put on, and the sponge is complete.

The rod is kept in its place by a spiral spring working in the end of the female screw. As soon as the man has forced the sponge home, it expands and fills up the whole of the chamber. (Fig. 14). I have put out with it slow match, quick match, live coals, burning oakum, and all sorts of combustibles. The sponge expands about an inch and a quarter, and entirely fills up the end of the chamber of the gun.

You see that to force the sponge home, a certain amount of pressure is required. In order to know if the sponge is forced home, I have here for beginners, an instrument which I call a "Tell-tale." (Fig. 15). This spiral spring is equal to a pressure of 40 lbs. If you put that pressure on the sponge, the gong attached to it will strike; but unless the man puts 40 lbs. pressure upon the sponge, the gong will not strike. My new sponge is intended for men who have just joined the service, and are going through their instruction.

ANTI-TORPEDO VESSEL.

I have here what I call an anti-torpedo vessel. (Figs. 16, 17). It is supposed to lead the way for a fleet going in to attack a place. She is not impregnable or impenetrable; but she would receive a number of discharges from torpedoes before she would sink. She is intended for a forlorn hope, going in to clear the way before the storming party come on, and she would be manned by volunteers. She is built entirely in cells. Half these cells are to be used as coal-bunkers, magazines, water-tanks, &c. The other half I leave empty to give buoyancy. Here is the engine-room, with Admiral Elliot's turbine; there is, therefore, no screw to come to grief. We will say that this cell is the one under which a torpedo bursts. The torpedo blows it up, and sends it where you like. The cells round it are perfectly intact, and the water rises in it to the height of the water outside; the column of water not in the least depressing the ship. It would be like a screw well, with the water rising up and down in it. The ends before and abaft the cells are water-tight. (Figs. 16, 17). The forecastle would be divided into water-tight compartments. Such a vessel would require very few men, one gun's crew, one man to command, and one to steer. Captain Inglefield's steering apparatus would be a *sine quâ non*. You see that the cells come down, and are rivetted to the iron skin; and are again rivetted lower down to the bottom. (Fig. 16). Each cell forms a little ship in itself. Destroy one of these cells, and you have still other vessels. The drawing is on the scale of a gun-boat, 100 feet long, 25 feet beam. The ship contains twenty-eight of these cells besides the air-tight compartments. I thought of giving her a greater rise of floor, but I could not get stability. I gave her a flat floor, and large bilge-pieces (Fig. 18) to steady her. She is not intended for a sea-going ship. Her engines will only give her four or five knots in order to stem a strong tide. I purpose to carry one monster gun of 600 lbs. She is to be towed to the place to be attacked, and is intended to clear the way, the other vessels following in her wake. Very few provisions would be required, very little coal, and few stores.

DOUBLE-ACTION LOCK.

I have here also a double-action lock. Persons acquainted with gunnery know that two men, Nos. 1 and 2, attend the lock. When No. 1 has got his sight on, he has to wait for No. 2 to cock the lock. By means of my double-action lock, No. 1 has entire control of the gun himself. No. 1 slacks one end of the trigger line, which is an endless rope, and holds the other at the ready. As soon as the sight is on, he pulls it. He has not got to tell No. 2 to cock the lock, nor has he to wait for anybody. He has the gun entirely under his own control. For the ordinary tube will be substituted a tube with a top like the head of a large blanket-pin.

The CHAIRMAN: With reference to your external plug. I do not quite understand how you ascertain the position of a shot hole from outside the ship.

Lieutenant GILMORE: If the ship roll, and exposes a hole, she will show where that hole is. You take this rod to the nearest socket, lower it down until it comes on a level with the shot-hole, it is kept in its place by guys. This rod is to be applied above the water-line on the flat of the ship. This curved rod is to be used below the water line, and with this screw you jamb the plate over the hole.

Lieutenant LEGGE, R.N.: What would be the time for plugging a hole when low down?

Lieutenant GILMORE: I should think three or four minutes. I forgot to tell you that I have made the plate an oval (Fig. 7) for the same reason that I had this made of an irregular form (Fig. 2). The longest part of the oval is to cover the largest diameter of the shot-hole. There is a thumb-screw here, which jams this on a central pin. I slacken it before I put it down to any angle you like, and it is fixed according to the length of the shot-hole.

Captain BOILEAU: What amount of lateral play does that admit of?

Lieutenant GILMORE: It will depend entirely upon the length of the rod. Here is the radius; you can work it to any angle you like. As a rule, shot-holes are at or a little underneath the water-line.

The CHAIRMAN: Have you sockets fitted on the ship's side?

Lieutenant GILMORE: These are fitted on the ship's side at intervals of about 30 feet. They would form part of the iron plate.

The CHAIRMAN: What is the weight of that stopper in an iron ship?

Lieutenant GILMORE: About $2\frac{1}{2}$ cwt. It looks very heavy on account of this thickness of gutta-percha. It is made with a flange edge, which on being pressed against the side expands.

Captain INGLESFIELD: The pressure of the external column of water would tend to keep it in its place?

Lieutenant GILMORE: Yes. Having a large face to the stopper, you might move it along without feeling for the shot-hole. The suction of the water would draw it over the hole.

Lieutenant LEGGE: Is the spindle of that expansive apparatus made of iron? because, supposing a shot should not strike straight, but should take an upward direction, would it not be difficult to put that apparatus through the hole?

Lieutenant GILMORE: You could put this through.

Lieutenant LEGGE: What is the diameter of the spindle?

Lieutenant GILMORE: The spindle is seven-eighths of an inch.

Lieutenant LEGGE: If the shot should not take a direct course, you would hardly get the spindle to bend sufficiently.

Lieutenant GILMORE: You can get it in at any angle, either straightforward or sideways.

Lieutenant LEGGE: I can well understand that you could, if the hole were straight, but supposing there were 18 inches of wood-backing and the shot, after it had got through the armour-plate, should rise?

Lieutenant GILMORE: I think if a shot penetrated the armour-plating it would not be deflected by the wood-backing. There are many cases in an iron vessel where you could not apply the internal shot-plug, and there I have the outward one to fall back upon.

Captain INGLESFIELD: I think the torpedo-vessel, to men who are likely to be put in the position of having to engage a battery on a foreign coast, is really a most important invention; for I am quite satisfied, that in these days the thing most likely to cause a panic amongst men, perhaps even amongst Officers, is the approaching a coast where torpedoes are supposed to lie. It is very well known that the action of a torpedo is such, that the instant a vessel touches it, almost at the same instant, she goes to the bottom. That is to say, a hole is made so completely through her, that the water rushes in, and there is small chance of any one escaping. That is the reason, I say, why the dread of torpedoes is likely to cause a panic amongst the men. I do think that a vessel such as has been proposed by Lieutenant Gilmore, is the best way of meeting that difficulty in approaching an enemy's coast; for that vessel

manned by volunteers, taking the rough edge off all the torpedoes that lie in the route, will be safely followed by the rest of the squadron; and the oftener she was blown up, the more satisfied of their own safety would they be. I must congratulate Mr. Gilmore on developing this idea, because I feel if I were commanding a squadron and taking it in, that this vessel of Mr. Gilmore's would be the best safeguard that it could have in approaching a shore where torpedoes were supposed to exist.

Lieutenant GILMORE: I propose to have a chain attached to the vessel, which would drag after her and explode the torpedoes as she went.

Captain HORTON, R.N.: Would the vessel have substance sufficient to resist the explosion of any considerable torpedoes?

Lieutenant GILMORE: The less substance the better. If you had a rigid substance the explosion of the torpedo would drive up all the cells immediately around it; but by having thin iron plates the explosion finds vent at once, and comes up through the cells. If you had a thick 5-inch bottom, the effect would be to smash the whole.

Captain HORTON: But if a torpedo explodes over an area of 20 feet in diameter, which is not a large space, it would almost cover the beam of a vessel, 25 feet wide.

Lieutenant GILMORE: This design is merely drawn on the lines of a gun-boat. You might have the vessel any size you like.

Captain HORTON: My fear would be that with a vessel of such small dimensions, there would be great danger of her being cut in two by a torpedo.

Lieutenant GILMORE: If a torpedo burst, there would be a cushion of water between the torpedo and the vessel, which would tend to prevent any damage being done; whereas if the torpedo bursts immediately under the vessel, the action comes at once on the cells directly over the torpedo.

Captain HORTON: I forget the precise dimensions you gave.

Lieutenant GILMORE: This is the dimension of a 40-horse power gun-boat. The cells are 5 feet 8 inches by 4 feet 3 inches. Then, you have at the end these water-proof partitions.

Captain HORTON: I spoke because I happen to have seen a good many explosions with experimental torpedoes; and they have left me with the impression that the area of destruction was larger than you have stated.

Lieutenant GILMORE: I had the pleasure of going down with you on one occasion, and seeing Harvey's torpedo.

The CHAIRMAN: We are much obliged to Lieutenant Gilmore for having brought before us these novel inventions of his fertile genius, and we return him our best thanks for his explanations.

DESCRIPTION OF PLATE II.

FIGS. 1, 2, 3.—*Expanding-Shot-Plug, applied from inside.*—A. Shot-plug previous to expansion. B. Shot-plug expanded, external view. C. Shot-plug expanded, internal view. D. Shield to protect plug whilst being thrust out through jagged hole. E. Arms which spread the canvass and fearnought composing the stopper. F. Conical head of shot-plug. G. Rod of plug having a worm on it. H. Fly-nut screwing up against bearing-rod I, which goes across inside of shot-hole. K. Metal ring securing plug, until the arms are clear of shot-hole, when it is pulled off by jigg line L. M. Expanding rod with disc-end N, which, pressing against the inside of plug at F, opens the plug and keeps it expanded.

FIGS. 4, 5, 6, 7, 8, 11, and 12, *show Shot-hole Stopper applied from outside, and various fittings.*—A. Rods. B. Movable box and screw. C. Movable box and stud. D. Stopper plates faced with gutta-percha. E. Central pin. F. Dutch joint. G. Locking-nut, by slacking which the pitch of plate may be altered, as in H, so as to place greatest diameter of oval over greatest length of shot-hole. K. Loops for guys. L. Loops for lowering rod.

FIG. 8 shows the action of central pin and Dutch joint in turning the stopper in under bilge, the dotted line showing the perpendicular.

FIG. 9.—Section of ship's side, showing shot-hole B, with stopper being placed over it, and D stopped with internal stopper; AA, guys; C, capstan bar for derrick; SS, sockets; M, man ready to heave up screw.

FIG. 10.—Showing shot-hole covered by stopper, 8 feet below water-line, and on the turn of the bilge.

FIGS. 16, 17, 18, 19.—*Description of Anti-Torpedo Vessel.*—A. Upper deck. B. Water-line. C. Shows the division of the alternate cells into double water-tight compartments (empty). D. Armour plate from 2 feet below water-line to 3 feet above. E. Double bottom, divided into compartments of the same superficial area as the cells. F. Cells rivetted to inner skin. G. Junction of cells. H. Engine-room. I. Water-tight compartments. J. Turret. K. Nozzle from turbine. L. Derrick and groper. M. Groping rake and torpedo.

LECTURE.

Friday, January 15th, 1869.

MAJOR-GENERAL THE HON. JAMES LINDSAY, Inspector-General of Reserve Forces, in the Chair.

THE DISTRIBUTION OF OUR WAR FORCES. PART I.

By Captain J. C. R. COLOMB, Royal Marine Artillery.

THE distribution of our war forces covers such a vast extent of ground and involves so many questions of national importance, that I feel some explanation is due to this meeting for my apparent audacity in attempting to bring before it so large a subject. When it is remembered that the distribution of the Army is generally considered to be something entirely distinct from the distribution of the Navy, and *vice versâ*, and that both these questions have engaged and are absorbing the attention of eminent men, I feel that I may well be thought rash in attempting to deal with the two combined.

My reason for taking the Army and Navy together, under the head of War Forces, is simply that in the matter of distribution I am unable to see how it is possible to separate the one from the other. I am fully aware that this is not the common opinion, for, as a rule, it will be found that persons deeply interested in the warlike condition of this country may be divided into two classes—those who regard it from a purely naval point of view, and those who confine their attention exclusively to the military bearings of the question.

Theoretically, and by the thorough good feeling which exists between the sister services, they are the United Services, and practically they are united by the common purpose for which they exist, namely, national safety. Now let us take this common ground on which the services meet, and from this starting point investigate how far the national safety is dependent upon each, and in the first instance let us come to a clear understanding as to what is meant by the term, national safety. Unfortunately many persons seem to think that it means nothing more than the safety of that part of the Empire called the British Isles, and that national defence means the securing of Great Britain and Ireland against invasion. Now unquestionably the defence

of the United Kingdom against invasion is an object of primary importance, but to suppose that this is the one thing needful in the matter of national defence, is a grievous error.

The sources of our greatness are the possession of India and our commercial prosperity—without India and without commerce we should be at the bottom of the scale of civilized nations. Bearing this in mind, let us suppose that the view which limits national defence to the protection of Great Britain and Ireland against invasion be practically adopted, and that the whole resources of the country have been wholly and exclusively directed to rendering the *soil* of the British Isles secure, and that this object has been fully attained, what would our position be in time of aggressive war on the part of one or more great powers? Does it not stand to reason that as the object of all aggressive war is either to acquire territory, or to weaken, if not destroy, the power of the nation against which war is made, the easiest and the safest mode is adopted to carry out that object; under the circumstances we have supposed, therefore, an enemy would naturally confine his efforts to destroying our commerce and our power in India, leaving the British Isles to watch this proceeding with impotent dismay.

The value of India to the Empire is something tangible, and the probable result of its loss to England is something easily understood by all, but our commercial prosperity is a vague term, and though it carries to the mind a conviction of stupendous wealth, the effects upon the country of its complete or partial interruption is not so easily calculated, and, therefore, we are but too apt to fall into a habit of generalizing upon this subject. Now for all practical purposes information must be definite and precise, consequently, I desire to draw your attention to a few facts relative to the value of our commerce in order to establish the necessity which exists for considering its protection as an integral part of national defence.

Our commercial prosperity is in direct proportion to the freedom with which we can carry on trade with our colonies and other countries. Commerce is in fact the link that binds together the several interests of the scattered territories composing the Empire.

If we take the trade returns for the year 1866, we find that the total imports into the United Kingdom amounted in value to £295,000,000 sterling, of which upwards of £72,000,000 came from our own possessions, and that the value of British produce alone, exported from the United Kingdom during that year, amounted in value to £188,000,000, of which more than £53,000,000 went to British possessions, the total value of exports from the United Kingdom (taking British and foreign produce together) came to £239,000,000, therefore the total value of articles *en route* to and from the United Kingdom during that year amounted to £534,000,000 sterling.

It is worthy of remark that our total annual exports and imports exceed in value those of Germany and France taken together, are greater than those of all Europe, exclusive of those two countries, and are nearly four times as great as those of the United States of America.

Now if we strike a monthly average of the value of our exports and

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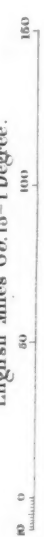
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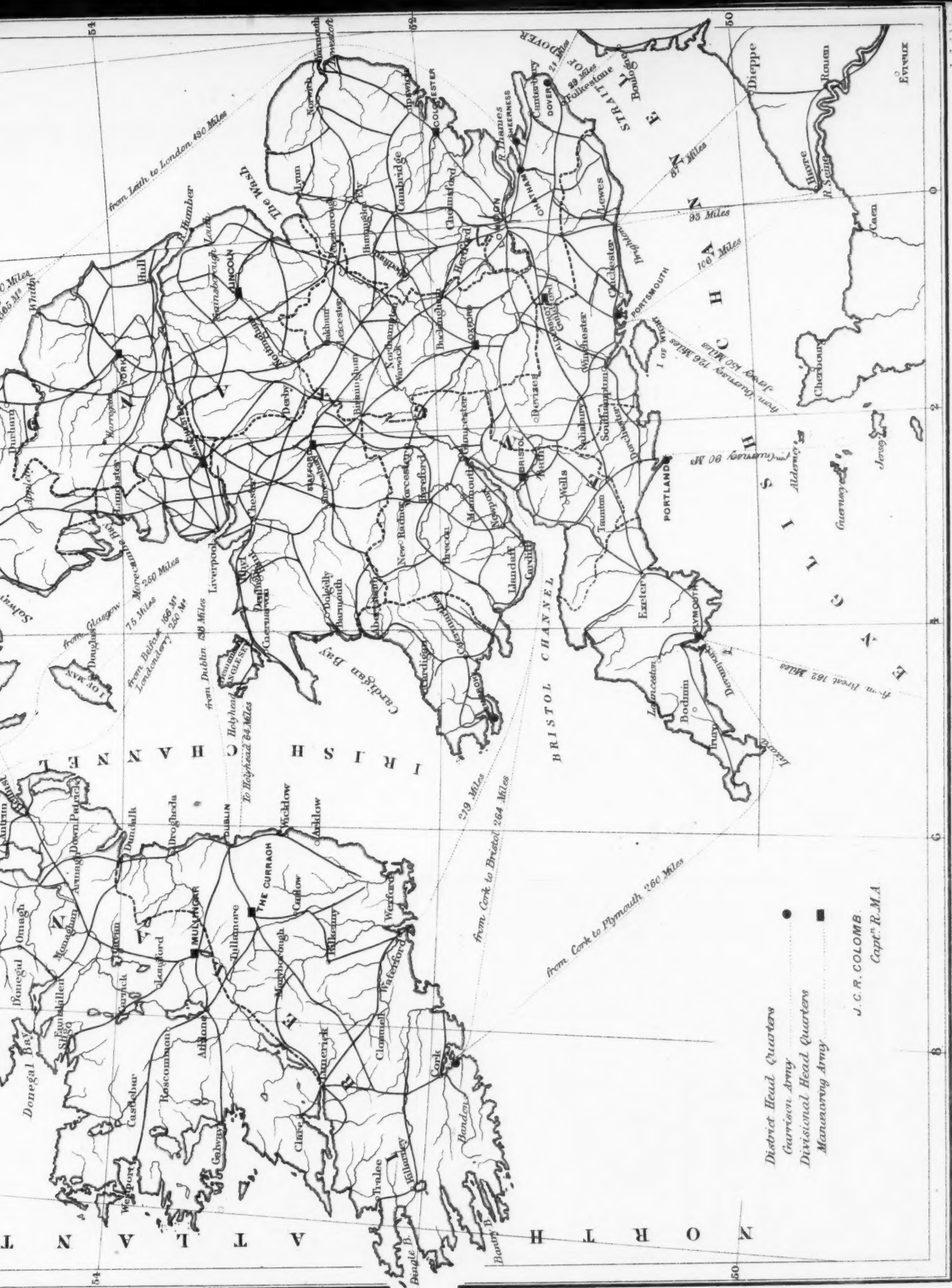


MAP OF GREAT BRITAIN AND IRELAND

*Showing principal Lines of Rail and the proposed
distribution of Garrison & Manning Armies.*

English Miles 69.15 = 1 Degree.





imports, we find it to be $44\frac{1}{2}$ millions. Supposing, therefore, the trade of the United Kingdom to be completely interrupted, the loss on commerce may be estimated at the rate of $44\frac{1}{2}$ millions per month. Under these circumstances, and with the above figures before us, the fallacy of supposing that national defence involves nothing more than the security of the United Kingdom *against invasion* is sufficiently evident. If the high roads of the world are closed to us by the presence of armed and opposing forces, against which we are unable to contend, the results would be almost, if not quite, as disastrous to the Empire as invasion itself. Hence it is that any scheme for national defence must provide for three things:—

1st. The defence of the United Kingdom.

2ndly. The protection of our commerce.

3rdly. The occupation of India.

It is upon the proper fulfilment of these three great requirements that our national safety will mainly depend, and it is for this we require war forces.

Now as regards the defences of the United Kingdom against invasion—it is to the Army and its Reserves that we must look for protection, but the Navy, represented by a Channel Fleet, is its powerful and necessary adjunct.

In the case of invasion, the Navy would be a mighty auxiliary to the Army, but the latter could afford no assistance, and would be but a host of spectators were our enemy's operations directed only against the Channel. Again, to protect our commerce, we require a Navy, but in order to enable the Fleets composing it to act, they must have fixed bases of operations, and these must be secured to them by land forces, consequently in the second requirement, the Army steps in as auxiliary to the Fleet.

Lastly, for the occupation of India, we require an Army; but the safety and efficiency of that Army depends upon our keeping open our communication with that country—this duty can only be performed by the Navy. These are briefly my reasons for asserting that the distribution of the Army and Navy are so intimately connected, that it is impossible to consider justly the distribution of one apart from that of the other.

Before passing to details, I would lay before you some general principles, which it appears to me desirable to establish.

As our war forces exist to meet the exigencies of war, they should be placed in such positions during peace, as would best enable them to act to the greatest advantage should that unhappy contingency arise.

Next, I think it may be fairly assumed, that in the matter of national defence, we are bound to look to the *general* welfare of the Empire. But when we remember the vast extent of our territories scattered as they are over the face of the globe, it is manifestly impossible to take the whole burden of their defence upon our own shoulders.

The question of defending the United Kingdom is of paramount importance, because it is the seat of Government, the base of

operations, the citadel in fact of the whole Empire; but as regards our other territories—always excepting India—it is reasonable to say that those colonies and dependencies, whose geographical position and natural advantages do not entitle them to be considered as military positions necessary for the general safety of the Empire, must defend themselves. There are many places, which, for the sake of our communications we must strain every nerve to hold against all odds, and these I shall particularize hereafter, but to the rest of our possessions, we are compelled by our limited means to say, defend yourselves from direct attack, we can do no more than guard the communications which are common to us all. We should say this, because it is useless and wrong to hold out hopes of military assistance, which, in their hour of danger, we should have to withdraw, and it is evident, that if we can secure these high roads to ourselves, and consequently to them, they would, with the sole exception of our North American Provinces, now called "Canadia," be virtually excluded from the probability of attack.

When it is remembered that the area of the United Kingdom is one-thirtieth part of the total area of the British Empire; that its population is less than one-fifth of the total population of the Empire, and that the greater portion of our war forces is furnished by that small proportion of the population, it is plain that we must rigidly economise our forces by carefully choosing the best possible defensive positions for them, so as to command that which is essentially necessary to the military safety of the Empire, namely, "*its communications*." We must, in short, by "strategy" make good the deficiency in respect of numerical military strength.

In speaking of Canadia I know I am treading upon delicate ground, because the possibility or advisability of its defence is a subject of much dispute amongst military men, but having particularly alluded to it, I will state my reasons for thinking it should be left to defend itself—they are these: In the first place we cannot keep open our communications with that country all the year round, because nature closes them.

2ndly. The war which would threaten our North American Provinces would of all others be the one which would most seriously endanger our communications generally. We should have enough upon our hands without undertaking the defence of an extensive frontier.

3rdly. Whilst recognizing the fact that "Canadia" possesses a reserve of militia and volunteers, numbering upwards of 200,000 men, we must not forget that any regular military force we could possibly dispatch to its assistance, though but a small contingent in respect of numbers as compared with this local reserve, would be large in comparison to the total strength of our regular army, if we exclude, as we must, the number required for India.

4thly. If we determine to engage in the task of defending "Canadia," the energies and resources required for that particular purpose would be just so much deducted from the means otherwise available for the general safety of the Empire. We must therefore call upon the rest of our dominions to make a sacrifice of a certain portion of their security;

we "rob a good many Peters to pay one Paul." If we succeeded in defending our North American Provinces, some of our other possessions would most probably suffer; if we failed in the attempt, "Canadia" would be no worse off than if it had not been made, but other of our territories would still lose by the transaction, and the whole Empire would feel the loss of prestige consequent upon failure.

Lastly. Whether we are able to defend "Canadia" is, to say the least, doubtful; that it is of no value as a military outpost is, however, certain; surely, therefore, to endeavour to hold, at considerable cost, a doubtful position of no value is false in principle.

These are some of my reasons for concluding that military expediency forbids the attempt. Under these circumstances, the removal of our regular forces from that part of our dominions follows as an inevitable necessity, for leaving them there now, amounts to "holding out hopes" of military assistance, which, in the hour of danger, we should be "compelled to withdraw." If we are not going to defend the Canadian frontier, there is another special reason for advocating the removal of the troops now quartered there. If, unhappily, a rupture with the United States were to occur at a certain time of year, we should be forced to leave them where they are; they would be cut off from us by weather, but, laying the physical difficulty aside, and supposing war to break out at a favourable period of the year, it would become a very serious question whether it would not be better to leave them where they were, rather than depress the public mind and insult "Canadia" by evacuating the country the moment any real danger appeared.

It may be argued that the presence of a regular force in that country is necessary for the repression of exceptional disturbances, such as the late "Fenian" outbreak; but I think it may be assumed that if the local forces are not equal to such a small emergency, it is useless to expect that they can meet the exigencies of more serious danger; in fact, the Fenian raids may be regarded as the means of giving the reserves of "Canadia" some experience in the art of war, and may therefore be of some advantage to those forces.

By all means, in peace and war, let us give to our North American provinces, and to all our other dominions, all the assistance we can in the shape of experienced officers and military equipment, but do not let us risk our regular forces in the direct defence of any portion of our territories, the possession of which is not essentially necessary to the safety of the state. Let us guard against the military blunder of leaving our communications and our whole position exposed, in order to defend comparatively small, and, in a purely military sense, valueless posts. Let "Canadia" and all our colonies and territories unnecessary to the Empire as military posts, fully and clearly understand that we will never suffer them to be wrested from the mother country, that any attempt to do so will bring down upon the aggressor the vengeance of England; but that they must rely on themselves for protection from direct assault, in order to leave the regular forces of the United Kingdom free to act in such a manner as will best make that vengeance felt.

I will now consider separately the distribution of our war forces for the performance of the three cardinal duties imposed upon them.

Direct assault upon Great Britain or Ireland may be placed under two heads:—

- 1st. Invasion, or the landing of a foreign army, with a view either to marching on the capital, overrunning the country, or taking our arsenals and dockyards in reverse.
- 2nd. Attack upon one or more of those fixed and fortified arsenals and dockyards, either for the sole purpose of their destruction, in order to cripple by a single blow the source of our naval strength, or with the intention of boldly seizing a strong position, turning the defences against us, and thus establishing a strong base for ulterior operations.

If the first plan be adopted, we know not at what points to expect attack; if the second is followed, we can pretty well guess them.

The first plan offers this great advantage to an enemy—more chance of taking the point of attack by surprise; therefore, it appears to me that the distribution of our force should have special reference to meeting this mode of attack, due precaution being taken at the same time to provide for the other contingency.

If we would know the probable course of action which would be taken by an enemy following out the first plan, we find it concisely described in the report of the Defence Commissioners as follows:—

“The object of an enemy would be, in the first instance, to land a sufficient force on some unprotected part of the coast, to enable him to seize and hold a position under cover of which the invading army might be disembarked. With the power of concentration which steam now affords, such a force might be assembled before daylight upon any point selected for the attempt, and thrown on shore in two or three hours.”

From this it is quite evident that the success of such an expedition would chiefly depend upon the amount of time allowed in the first instance, for an unopposed landing. Time is what an enemy would most require to make good a footing on British soil, therefore it is *time* that we must most rigorously deny him. We can only do this by taking advantage of the network of railroads and telegraphs, and distributing the forces with reference to them, so as to obtain the power of concentration on any given point in the shortest possible space of time.

To arrive at practical conclusions as to the precise nature of that distribution which will best fulfil these conditions, it is necessary to take into consideration three things:—

1. The ground to be defended.
2. The means of communication.
3. The circumstances by which the nature of the forces to be employed may be determined.

Let us investigate these three things, in order to determine the nature of the distribution which would best meet the case of an enemy following out the programme placed under the second head.

1st. As to ground. The fixed and more or less fortified points of attack in Great Britain are, Woolwich, Chatham, Dover, Portsmouth, Portland, Plymouth, and Pembroke, and in Ireland, Cork. These are

all included in the scheme drawn up by the "Defence Commissioners." I will suppose that the measures proposed for rendering complete the defensive works at each place have been carried out, consequently I take their estimate of the required strength of these garrisons at the time of expected attack (see Appendix, Table 1).

2nd. As to communications. Each one of these places possesses extraordinary advantages with respect to the power of rapid communication with the surrounding districts, and the interior. The most favoured are Woolwich, Chatham, Portsmouth, and Portland; the least, Plymouth.

3rd. The circumstances by which the nature of the force to be employed may be determined, are set forth in clause 9 of the Defence Commission Report, which runs as follows:—"The objects proposed to be obtained by fortifying any place, are to enable a small body of troops to resist a superior force which may attack it, or to enable partially trained bodies of men to contend successfully with those more perfectly trained and disciplined. There seems no reason to doubt that such troops as may be got together from the disembodied or less perfectly trained militia, with local or other volunteers, would, with an admixture of regular soldiers, be able to defend our dock-yards against very superior numbers."

From this it is clear that the garrisons of these positions may be chiefly furnished by our reserve forces. It may be argued that these are places of such vast importance to the country, that it would be injudicious to leave their defence chiefly in the hands of any but regular troops. It must, however, be remembered, that their defence is but a part of the general subject—defence against invasion—and it will be seen later that we require our regular forces elsewhere. Further, let the words of the Duke of Wellington be called to mind when he says—"I shall be deemed foolhardy in engaging for the defence of the Empire with an Army composed of such a force of militia. I may be so. I confess it. I should infinitely prefer, and should feel more confidence in, an Army of regular troops, but I know that I shall not have them. I may have the others."

Having fixed the nature of the forces to be principally employed in the defence of our fortified positions, the next thing to be done is to "get them together."

Now, disembodied Militia and Volunteers save us the trouble of distributing them, for they distribute themselves, consequently for all practical purposes we must take them as we find them, and our efforts must be directed to bringing them together *at the right time*, and at *the points where they would be required to act*. It need not be asked what is the right time? for the Duke of Wellington fixed it at "the moment war is declared." So far then, we know the nature of the force, we know the points, and we know the time. But here it may be asked, what proportion of regular troops is required? How is the "admixture" to be estimated. I think we may conclude that the necessary number of regular troops may be taken at less than half the total garrisons. Indeed, when it is borne in mind that we are now considering *only* direct assault upon these fortresses, which really means bombard-

ment from the sea, or attack upon the sea defences, we may fairly conclude that *one-third* regular troops would be sufficient, provided more are within reach to re-inforce the garrisons in case of necessity. Assuming this to be a correct proportion, I will now take the counties surrounding these places in England, and show how far they are capable of meeting the demand upon their reserve forces for two-thirds of the garrisons.

Table 2 is a rough statement of the reserves at and about these fortified points, and I think it will be found sufficiently accurate, although I have been unable to obtain official returns.

It will be seen by this that Cornwall and Devon, taken together, can easily supply two-thirds of the war garrison of Plymouth. Dorset can provide in like manner for Portland. Wilts, Sussex, and Hants, very nearly make up the number required for Portsmouth, and Kent and Surrey can supply Woolwich, Dover, and Chatham.

Thus the south of England would be divided into districts.

The Plymouth district consisting of Cornwall and Devon.

The Portland district consisting of Dorset.

The Portsmouth district consisting of Hants, Wilts, and Sussex.

The Dover and Chatham district, of Kent and Surrey.

Now, if it be a true principle, and I maintain that it is, that "troops" should be placed in such positions during peace as would best enable "them to act to the greatest advantage on the breaking out of war," it is pretty clear that expediency points to the advisability of training the reserve forces of Cornwall and Devon for the special purpose of defending Plymouth, those of Dorset for Portland, and so on. The annual training of the Militia, the annual reviews and gatherings of the Volunteers of the counties I have named, would then take place on the ground they would in reality be called on to defend. This is the broad principle I venture to advocate. Each annual training would then be a real preparation for war. Officers and men would learn their duties and their places, and each would regard the fortified point of the district to which he belonged, as his post of honour and his military home. The fortifications provide incidentally spare barrack accommodation. The Militia require barracks in which to train their men. Let the southern counties thus have the barracks they would occupy in war.

As regards the admixture of regular troops for these garrisons, it is essential that the whole, or at least the greater proportion, should consist of artillery; but as our regular forces are required for the general service of the Empire, it is necessary to consider the whole question of its defence before proceeding to details as to numbers.

It will be observed that I have omitted to mention the Channel Islands, which, to borrow the late Sir William Napier's words, "are more intimately connected with the defence of England than is generally supposed." Our position there properly comes under the head of "fixed points," and although it is an outpost, I will say a few words respecting it before passing to the rest of my subject. My best plan is to summarize the late Sir W. Napier's opinion, which amounts to this, "Jersey and Guernsey must fall to France whenever she

"chooses to annex them." Alderney must and can be held by us with 1,000 regular troops and the island militia.*

Now take the case of an enemy following out the plan of operations placed under the first head.

We do not know the exact points of attack, but there are probabilities which help us to arrive at general conclusions, bearing on the question of the distribution best calculated to meet the emergency. To these I will briefly allude. First of all from what quarter is an attack of this nature to be expected? Not from Russia alone with her ports closed for a great portion of the year by ice; nor from Prussia, for the same reason; the other powers to the westward of these two need not be considered until we come to France.

Well, then, if unhappily France be the aggressor, and wants to march on the capital, over-run the country, or take a fortified position in reverse, where is it probable she will attempt to land her army? We can only answer we don't exactly know, but we *do* know that the south is more open to attack than the north. If the object be a march on London, it is not likely any point of the coast at a great distance from London would be chosen for the landing of the main body, as the difficulty of keeping open the line of communications in the rear of the advancing army would increase with its length. Hence in this instance the south or part of the east coast would most likely be threatened. If the object be to over-run the country with perhaps the ulterior motive of concentration, we may look for assault at several different places; if the intention be to take one of our fortified points in reverse, we may expect the landing to be attempted somewhere in the vicinity of one of those points. Pages—I might say—volumes, have been written in the endeavour to determine the probable point of attack, and the only safe conclusion that can be drawn from the mass of evidence and opinions is a very general one. I think it is briefly this, that, owing to a variety of circumstances, the points most likely to be selected are situated on that part of the coast lying between the Humber and Penzance. This line, as the Royal Commissioners tell us, is "750 miles long, and there is an aggregate of nearly 300 miles on "which a landing may be effected." The practical lesson to be learnt from this general conclusion may be thus summed up: the forces intended to meet the case of an enemy acting on the first plan of operations, must be distributed in such a manner as will best secure the power of rapid concentration of large bodies of troops on or near any given portion of this assailable coast line; this would also be consistent with the duty of keeping open the communications of our fortified positions with the interior. I must here explain that by "concentration of large bodies of troops" I do *not* mean the assembly of a variety of small and fragmentary portions of regiments or even brigades, and so collecting a force equal to an Army *only* in number, but I intend to convey the idea of mobilized and complete brigades, or divisions of an Army converging with rapidity and precision on any named point.

* See Appendix to the Life of General Sir W. Napier.

To avoid confusion I will here adopt the term used by the "Defence Commission," and call the force intended for the defence of the coast line "*The Manœuvring Army*," in contra-distinction to the force required for the defence of the fortresses, which may be termed the "*Garrison Army*." The more important consideration relative to the distribution of this Manœuvring Army, is that which has reference to communications, for the defensive force is comparatively small, while the line of defence is of great extent. It is unnecessary to consider the circumstances which determine the nature of the force to be employed, for there is no choice, nor possibility of selection. The Manœuvring Army consists of the balance remaining of the military forces in Great Britain after deducting those required for the "*Garrison Army*." The more regular troops the better, but for obvious reasons the bulk of this manœuvring force must be composed of regular and irregular reserves—militia and volunteers—and as I before remarked these forces distribute themselves. What we have to do, therefore, is to devise means by which the forces scattered over the face of Great Britain can be most readily brought to bear in organized masses upon any point on the coast lying between Penzance and the Humber.

This can best be done by grouping the counties into districts, organizing the reserve forces of these districts into complete brigades, assigning to each brigade so formed, an appointed place in a division, and allotting to each division such position in the "*Manœuvring Army*," as is most convenient and suitable to the general object intended to be accomplished by the "*Manœuvring Army*," namely, the defence of the coast.

As an illustration of this principle I have prepared Tables 3 and 4. It is imperfect and open to many grave objections as regards details, but I trust the largeness of the question may be allowed to plead my excuse for its defects. In drawing it up I have been guided by considerations of a general kind, and a brief allusion to these will be the best explanation of the tables.

In arranging the counties, I have endeavoured to secure a convenient number of men to each district, so as to admit of a "brigade-organization." I have not, however, attempted to subdivide London, Lancaster, or Stafford into districts, as that would more properly come under the head of "organization." In fixing the district head-quarters, my object has been to obtain a central position, where the railways opening up the district, meet, at the same time looking to the means of direct communication with the head-quarters of the "division" to which the district belongs; and I have given the preference, where it was possible, to county towns. It seemed to me desirable that the grouping of the forces of the various districts into "divisions" should be made dependent upon two things, namely, convenience of numerical strength, and the facilities afforded by the existing lines of rail for intercommunication. In determining the situation of its head-quarters, I have considered the probable destination of the "division" after being called out and concentrated at its head-quarters for actual service. Now this distribution is framed in order to secure the rapid concentration of organized masses upon any portion of the more assailable coast line. Let us see

how it would answer the purpose. Supposing danger imminent, the first step to be taken is the gathering in of the forces at their district headquarters; the next, the moving of the brigades from those points to the headquarters of the "division." This would occupy a few hours. The position of the Manœuvring Army would then be as follows:—The 1st "division" at Aldershot; 2nd, Colchester; 3rd, Bristol; 4th, Oxford; 5th, Stafford; 6th, Lincoln; 7th, Manchester; 8th, York; 9th, Newcastle.

A reference to the map will show that these points are all, in a greater or less degree, centres of our railway systems. Aldershot, for example, commands the whole coast of Kent, Sussex, and Hants; Colchester is on the line of rail running along the coast of Essex, Suffolk, and Norfolk; Bristol is within easy reach of the coast of Dorset, Devon, and even Cornwall; the town of Lincoln is about equi-distant from any point of the coast of that shire.

That the south of England is more open to attack than the north, east, or west, needs no proof—it is evident to all; therefore, the principles of distribution of the forces for the protection of England should be consistent with the knowledge of this fact, consequently what we have to provide for is a general movement towards the south of all our forces on the eve of their being called on to act. Supposing the proposed distribution to be adopted, would it meet this requirement?

To find an answer to this question let us imagine that an attack is expected. The concentration of the "divisions" would have taken place "at the moment war was declared." Our next duty would be to guard against surprise, but it is impossible under the present political division of Europe for any portion of the east coast to be *absolutely* surprised, for no considerable force could pass Dover day or night without its being known a few minutes later, all over England. This limits the possibility of surprise, under existing circumstances, to an attack somewhere between Dover and Penzance. Under these circumstances, the first "division" would probably be moved from Aldershot to Tunbridge, the 3rd from Bristol to Exeter, the 4th from Oxford to Salisbury, the 5th from Stafford to Bristol, the 7th from Manchester to Aldershot, the 8th from York to Oxford, the 9th from Newcastle to Stafford, the southern Scotch reserves moving down and taking up the positions vacated in succession by the English "divisions," being thus ready to move rapidly to the support of the more advanced forces.

In less than 48 hours from the declaration of war, this might be the position of the "Manœuvring Army," and once in this position it seems to me impossible for a landing of any serious nature to take place without at once encountering the concentrated opposition of previously organized masses.

It is needless to point out the variety of combinations that could be made with a manœuvring army so situated. I confine myself to an illustration of the one which would most probably be required.

In the matter of the defence of Great Britain, I have taken the question of reserve forces first, for three reasons. 1st. Because the number of regular troops likely to be available for that duty would be small compared with the strength of our reserves, therefore it is upon

our reserves we must mainly rely. 2ndly. Because the more the military position of the reserve is improved, the more are our regulars left free to act for the general welfare of the whole Empire. 3rdly. Because more is to be done by example than precept, and consequently if the colonies see that the mother country has to look to reserve and irregular forces for self-defence, there is the more hope of their doing the same.

We now come to Ireland. Here the limited nature of the reserve forces and other circumstances render it necessary that the defence of this portion of the United Kingdom should be provided for independently of local resources. When treating of the defence of Ireland therefore, it is necessary to reverse part of what I have just said, hence the question of reserve forces must be taken last, and their arrangement must conform to that of the regular troops. It is impossible to enter fully into this subject at present, and I only propose to bring forward a few general principles. The duty of preserving internal order unfortunately influences the peace distribution, and this involves many and minor details of a nature altogether outside the object of this paper.

A large number of regular troops would be required, and larger re-inforcements must be at hand, at the "moment of expected attack." It is likely that an enemy whose real object was invasion of Great Britain, would try to create a diversion by attempting to throw a force detached from the main body upon the Irish coast; on the other hand Ireland might be the sole object of attack. The extent of this danger, however, is considerably modified by the difficulties attaching to great expeditions against a country separated by long distances from the base of offensive operations. In any case the south coast is most exposed. The fortified point is Cork harbour, and for its defensive works 2,500 men are required. The Duke of Wellington fixed 10,000 men as the number that should be at Cork at the moment war is declared. Now, as the principal portion of the force for the defence of Ireland is not local, its reinforcements must be drawn from Great Britain. The forces in Ireland may properly be regarded as the right wing of the Manœuvring Army of the United Kingdom, separated from the left by St. George's Channel, and at the moment of expected attack the left wing is liable to be more seriously threatened than the right. If the right requires reinforcements, they must come from the rear of the left, and, in short, the common reserves for both wings are composed of the force in Scotland. The most convenient points of entry for columns moving to the support of Ireland are Belfast and Dublin; the latter is the centre of the Irish railway system, but the former has the advantage of being the nearest to the reserves. As in England, so in Ireland, when danger threatens, we must be prepared for a general and rapid movement towards the South.

The same broad principle of massing troops and all available reserves at the centre of the railway systems commanding the assailable coast, may be applied to the forces in Ireland in much the same manner as to those in Great Britain, no matter what may be the nature of the peace distributions forced upon us by circumstances beyond control, and

peculiar to that part of the United Kingdom. And as it appears that the arrangement of the reserve forces, which are only required in actual war, should conform to those of the regular forces, the headquarters of the districts should be fixed at the centre of the railway systems. These are Dublin, Belfast, Cork, Limerick, the Curragh, Kilkenny, Athlone, Mullingar, and Inniskillen. Now, Cork being a point, the safety of which is of vital importance, its defence could not be more fitly and appropriately provided for than by leaving its protection in the hands of that tried and representative force of the country, the "Royal Irish Constabulary." The interior economy of that body better adapts it to purposes of local defence than to form an integral portion of the Manœuvring Army. Thus the regular troops might be left free to act for the general defence of Ireland. Table 5 will better explain these general ideas.

Questions relating to the defence of Ireland are interwoven with difficulties requiring time to enter upon, as may be gathered from a paragraph in one of the late Sir W. Napier's letters to General Shaw Kennedy, when, in speaking of the various places open to the attack of a hostile force, he says, "They, *i.e.*, the enemy, might go to Milford Haven, but that would not be very important. If they went to Ireland, I know not what to say or do."*

Next, as regards Scotland. Owing to its position, invasion or a land attack there, is in the last degree improbable. But nevertheless, that part of Great Britain would have to play a most important part in the defence of the United Kingdom. It would furnish the reserves for both England and Ireland. The peculiarities of the national character, the steady northern blood in fact, would give a power and character to the reserves, not to be estimated or measured by mere numerical strength. The same principles of distribution apply in this case, and the main object to be obtained is the power of dispatching organized columns of support to either or both wings of the "Manœuvring Army," with ease and rapidity. In this view I have sketched out the distribution in Table 6.

Such a distribution would admit of a complete and compact organization, give to each district its brigade staff responsible to the Officer commanding the "division," who, with his regular and reserve staff, should be the real head of the regular troops and reserve forces in the counties forming the "division" under his command. The outline is then complete.

Here for the present I leave that part of the subject relating to the defence of the United Kingdom, returning to it when the number of regular forces likely to be available for this duty can be fairly estimated, which cannot be done until the occupation of India and the protection of our commerce have been considered.

There is no necessity for any detailed statement respecting the British forces required for the occupation of India. We know that it must be held in peace as in war by military force. While we are on good terms with other great powers, a regular force must be main-

* Vide Life of Sir W. Napier, page 331.

tained in that country sufficient to preserve internal order and equal to any sudden local emergency which might probably arise. But in case our position should be reversed, we must be prepared to augment that force, and so render it capable of withstanding external pressure. Under such circumstances the mere fact of the presence of sufficient force in our Indian possessions will avail but little if we do not hold with a strong hand those intermediate positions between this country and those territories with a view to keeping open our communications, and making those halting-places secure which form the connecting links between the Army in India and its reserve in the United Kingdom. These are Gibraltar, Malta, and Aden. I will not here speak of those points on the Cape route, for their importance as military posts has more direct reference to the protection of our commerce. The peace garrisons of the places I have named require about 10,000 men.

The present British force in India may fairly be taken as an estimate of the number of regular troops required for that service for many years to come. In round numbers it is 64,000 men.* Now if this be the number necessary for the preservation of internal order and for meeting sudden contingencies, we may reasonably conclude that a very considerable increase would be required in the event of the frontier being threatened. The actual danger arising from such a circumstance is not to be weighed by the amount of force which could be brought to bear on the frontier, but by the effects it would produce upon the mind of the Indian people. "The power of Russia for mischief arises "not so much from the force she can muster, as from the insurrection "which her advance may create."† If the reinforcement would be required on the breaking out of war, it should be ready at hand during peace, and it is most desirable it should occupy such a position as would enable it to move to India in the shortest possible space of time.

If it be necessary, and most undoubtedly it is, to maintain in India a British force of upwards of 60,000 men, it should not be the *whole* British force.

India is England's most important possession, but it is contrary to all principle to suppose that even the greater part of the total available force should be pushed forward to hold a distant, difficult, and extensive territory. What would become of an Army so distributed? From whence are reserves and reliefs to be drawn in such a case? Is it possible to conceive the Imperial Army required for India being treated as a movable column without an imperial base, left to sink or swim as it best can?

Again, should India require reinforcements in consequence of any demonstrations on the part of Russia, it might be necessary at the same time to place the garrisons of Malta and Gibraltar on a war footing. Not only, therefore, must reserves be at hand for service in India, but we must be equally prepared to largely reinforce those garrisons. We

* The exact number in Estimates for 1868-9, is 64,466.

† Vide *Times*, 9th December, 1868.

should in that case require for duty in or on the road to India more than 100,000 men.

The United Kingdom being the head-quarters of that Empire of which India is a part, is the most fit and proper position for the reserves for Gibraltar, Malta, and India to occupy. It is the only place where they can be ready at hand to move into their positions in the shortest possible space of time; and defending Great Britain and Ireland is a duty entirely consistent with that of supporting the Army in India.

Our regular British Army consists of about 200,000; deducting the number required for Malta, Gibraltar, and India during peace, we have 126,000, but it cannot be said that any large portion of this force is available for any duty which would prevent its being immediately ready for service at those places, such as colonial service. Were we suddenly engaged in a war which simultaneously threatened India, Malta, Gibraltar, and the United Kingdom itself, as might happen in the case of a combination between Russia and France, the force left at home after the despatch of the necessary reinforcements would certainly be less than half our total Army. If then any considerable portion of this 126,000 is not forthcoming, what would become of India and the road to India on the breaking out of such a war; what consolation would be afforded by remembering that we have troops in our colonies, everywhere in fact but where they are wanted?

If France alone were to declare war against us we should have to fill up our Mediterranean garrisons; this would leave something less than 100,000 available for the defence of the United Kingdom. Of this number 77,000 only would form part of the Manœuvring Army, for 22,000, the one-third of the total garrisons of the fixed points, and 1,000 for Alderney, must be deducted, more than half this, 77,000, would probably be required in Ireland, so that, if in time of peace we have 126,000 regular troops in the United Kingdom, we can only calculate on the services of some 30,000 or 40,000 for the defence of the English coast line at the moment of expected attack.

In my next paper I hope to show that this distribution, limiting as it does the foreign service during peace of our regular Army to India, Aden, Malta, and Gibraltar, is the one best adapted to meeting the other great requirement—the protection of our commerce.

Now supposing this distribution to be carried out; supposing the organization and equipment of the forces to be perfect, supposing Gibraltar, Malta, and Aden to be impregnable, India and the United Kingdom to be secure, it would all go for nothing, it would be all useless—nay, worse than useless—when put to the crucial test of war, unless we command the communications between each and every one of those places.

A more powerful fleet than our own in the Channel, a more powerful fleet than our own in the Mediterranean, would convert the whole fabric of our military strength into a simple “lock up” and “lock out” of our military force.

APPENDIX.

TABLE 1.

TABLE showing garrisons required at each fortress in the United Kingdom at the moment of expected attack.

Woolwich	1,500
Chatham	13,000
Dover	6,000
Portsmouth and Isle of Wight	20,000
Portland	3,000
Plymouth	15,000
Pembroke	7,000
Cork Harbour	2,500
Total Garrison Army required	68,000

TABLE 2.

GREAT BRITAIN.

Garrison Army, consisting of—

Reserve forces	44,000
Regular troops	22,000
Total	66,000

Distribution of Reserve Forces.

Head Quarters.	Counties comprising Districts.	Reserve Forces.		
		Militia.	Volunteers.	Total.
Woolwich	Surrey	2,977	4,622	16,833
Chatham and Dover	Kent	2,600	6,634	
Portsmouth	Sussex	1,518	3,207	14,133
	Hants	2,729	3,892	
	Wilts	1,166	1,621	
Portland	Dorset	814	1,177	1,991
Plymouth	Devon	2,367	4,108	10,373
	Cornwall	1,579	2,319	
Pembroke	Pembrokeshire	384	595	2,314
	Cardiganshire	301	64	
	Caermarthenshire	486	484	
Total	Total	16,921	28,723	45,644

TABLE 3.

ENGLAND and WALES.—(Manœuvring Army.)

Distribution of the 1st, 2nd, 3rd, and 4th Divisions.

District Head Quarters.	Counties com- posing Districts.	Reserve Forces.*			Divisional Head Quarters and Strength.	
		Militia.	Volunteers.	Total.		
Aldershot {	London.. .. Middlesex ..	7,000	7,000 16,900	} 30,900	{ 1st Alder- shot 30,900	
Colchester {	Essex.. .. Suffolk ..	1,700 1,500	3,900 1,800	} 8,900	{ 2nd Colches- ter 18,900	
Norwich ..	Norfolk ..	2,700	2,300	} 5,000		
Cambridge {	Cambridge .. Huntingdon ..	800 300	1,000 400	} 2,500		
Bedford {	Beds Herts.. ..	500 800	600 600	} 2,500		
Bristol ..	Somerset ..	1,900	2,400	4,300		
Monmouth ..	Monmouth ..	700	2,400	3,100	{ 3rd Bristol 23,400	
Cardiff ..	Glamorgan ..	1,000	4,000	5,000		
Gloucester ..	Gloucester ..	2,000	3,100	5,100		
Hereford {	Hereford .. Brecon ..	500 300	1,600 400	} 2,900		
	Radnor ..	100				
Worcester ..	Worcester ..	1,300	1,700	3,000		
Oxford {	Oxford .. Berks.. .. Bucks.. ..	800 800 700	1,000 800 400	} 4,500		{ 4th Oxford 11,500
Northampton	Northampton	1,000	1,100		2,100	
Warwick ..	Warwick ..	1,100	1,900		3,000	
Leicester {	Leicester Rutland }	1,000	900		1,900	
					11,500	
					84,700	

* In round numbers.

TABLE 4.

ENGLAND and WALES.—(Manœuvring Army.)

Distribution of the 5th, 6th, 7th, 8th, and 9th Divisions.

District Head Quarters.	Counties com- posing Districts.	Reserve Forces.*			Divisional Head Quarters and Strength.
		Militia.	Volunteers.	Total.	
Stafford ..	Stafford ..	2,900	4,100	7,000	} 5th Stafford
Shrewsbury {	Salop ..	1,000	1,500	3,100	
	Montgomery ..	300	300		
Chester {	Chester ..	2,000	4,000	6,700	
	Flint ..	300	400		
Carnarvon {	Carnarvon ..	400	400	2,300	
	Anglesea ..	200	200		
	Denbigh ..	400	500		
	Merioneth ..	100	100		
					19,100
Lincoln ..	Lincoln ..	1,900	1,900	3,800	} 6th Lincoln
Nottingham ..	Nottingham ..	1,200	1,600	2,800	
Derby ..	Derby ..	1,300	1,500	2,800	
Sheffield {	Half of West Riding of York	3,100	5,000	8,100	
					17,500
Manchester	Lancaster ..	9,000	20,800	29,800	} 7th Man- chester
					29,800
Beverley {	E. Riding of York ..	1,000	1,500	2,500	} 8th York
Richmond ..	N. ditto ..					1,000	2,300	3,300
York ..	Half of W. do.	3,100	5,000	8,100	
					13,900
Carlisle {	Cumberland ..	900	1,300	3,000	} 9th New- castle
Westmoreland	300	500			
Durham ..	Durham ..	1,800	3,700	5,500	
Newcastle {	Northumber- land and Berwick ..	1,300	3,800	5,100	
					13,600
					93,900

* In round numbers.

TABLE 5.

IRELAND.

Distribution of Militia.

District Head Quarters.	Counties com- posing Districts.	Militia.	Total strength of District.	Divisional Head Quarters and Strength.
Cork	Cork	2,986	4,082	} 1st Curragh
	Kerry	1,096		
	Limerick	1,199		
Limerick	Tipperary	1,504	3,680	
	Clare	977		
	Kilkenny	719		
Kilkenny	Waterford	743	2,590	
	Wexford	817		
	Carlow	311		
Curragh	Kildare	459	1,500	
	Queen's Co.	522		
	King's Co.	519		
	Dublin	1,761	2,898	
Dublin	Wicklow	472		
	Meath	665		
				14,750
Mullingar	Westmeath	527	1,727	} 2nd Mullingar
	Longford	386		
	Cavan	814		
Athlone	Roscommon	812	2,292	
	Galway	1,480		
Castlebar	Mayo	1,254	1,254	
	Sligo	591		
Carrick	Leitrim	528	1,119	
	Fermanagh	534		
Enniskillen	Tyrone	1,187	1,721	
	Louth	492		
Dundalk	Monaghan	647	1,139	
	Armagh	900		
Newry	Down	1,472	2,372	
	Donegal	1,172		
Londonderry	Londonderry	875	2,047	
Belfast	Antrim	1,579		
				15,250
				30,000
For defence of Cork, Royal Irish Constabulary				10,000
				40,000

TABLE 6.

SCOTLAND.

Distribution of Reserve Forces.

District Head Quarters.	Counties com- posing Districts.	Militia.	Volunteers.	Total Strength of District.	Divisional Head Quarters and Strength.		
Dumfries. {	Kircudbright ..	.. ..	500	2,154	} 1st Glasgow	
	Wigton ..	.. ..	400			
	Dumfries ..	654	600				
Paisley .. {	Ayr ..	841	1,500	5,301			
	Renfrew ..	560	2,400				
	Lanark ..	1,911	8,100				
Glasgow .. {	Dumbarton ..	.. ..	1,300	11,311		
					18,766		
Stirling .. {	Stirling ..	599	1,000	2,099	} 2nd Edinburgh		
	Clackmannan ..	.. ..	500			
	Peebles ..	.. ..	200			
Peebles .. {	Selkirk ..	.. ..	200	1,400		
	Roxburgh ..	.. ..	400			
	Berwick ..	.. ..	600			
Edinburgh {	Edinburgh ..	878	4,800	7,093			
	Haddington ..	415	500				
	Linlithgow ..	.. ..	500			
Perth .. {	Perth ..	495	1,200	4,237			
	Fife ..	542	1,900				
	Kinross ..	.. ..	100			
Forfar .. {	Forfar ..	.. ..	2,700	4,276		
	Kincardine ..	776	800				
					19,105		
Aberdeen.. {	Aberdeen ..	741	3,200	3,941	} 3rd Aberdeen		
	Elgin ..	.. ..	900	1,600		
Elgin .. {	Nairn ..	.. ..	100			
	Banff ..	.. ..	600			
Inverness {	Inverness ..	692	1,300	3,507			
	Ross and Cromarty }	515	1,000 }				
					9,048		
Without Rail communication.					46,919		
{	Argyle }	381	1,500				
	Bute }						
	Sutherland	400
	Caithness	1,000
	Orkney and Shetland }					500

LECTURE.

Friday, January 29th, 1869.

CAPTAIN EDMUND PACKE in the Chair.

THE DISTRIBUTION OF OUR WAR FORCES. PART II.

By Captain J. C. R. COLOMB, Royal Marine Artillery.

WHEN last I had the honour of addressing a meeting here, I endeavoured to establish the necessity, which to my mind exists, for considering National Defence as involving three great requirements, namely:—

The defence of the United Kingdom.

The occupation of India.

The protection of our commerce.

I then attempted to explain the outline of a distribution to meet the first two of these; but, it was necessarily incomplete, owing to the fact that these three things are so intimately connected, that any one of them cannot properly be considered wholly by itself.

I will now briefly bring before you some general principles relative to the distribution of the forces for “the protection of our commerce.”

I trust I may be excused, if I repeat this afternoon a good deal of what I put forward in a pamphlet some two years ago.*

The protection of our commerce means in reality the securing of the Imperial communications commercial and military. I stated in my last paper that it would be useless to distribute forces for the defence of the United Kingdom, and the occupation of India, unless we at the same time provide for the safety of the routes between those places; and I would now remind you that, the communications of the Empire being the common property of all its component parts, it follows that their security is an Imperial necessity, and that our first duty towards our colonies and possessions is to provide the means by which the roads between us and them may be kept open. In time of peace this means nothing, in time of maritime war it would be a most difficult operation, and upon its successful accomplishment will depend not only their safety, but our own. The general principle of placing our forces in

* Protection of our Commerce: 1867.

such positions during peace, as will best enable them to act on the breaking out of war to the greatest advantage, applies with equal force to this part of my subject, but it is modified by another general principle peculiar to itself, which is this, that in time of peace we have to provide for the safety of our trading interests at places not in our possession, nor in that of any civilized power; but in time of maritime war, our object should be to ensure the safety of places in our possession, and afford protection not only to them, but to as great an area as possible around them. For this purpose, the fleet is of course the engine to employ; but in order to enable it to act, it must be divided into parts, these being distributed in different quarters of the globe, the strength of each part being in proportion to the forces against which it would probably have to contend, and to the interests it has to protect. As each of these fleets constantly requires repairs, stores, and reserves of men in order to enable it to act with a prospect of success, the protection of our commerce or communications would not be accomplished by the judicious distribution of the Navy, unless means are devised for securing to each fleet the power of self-support; therefore each fleet must be provided with a head-quarters, or base of operations, where all those things so essential to its vigorous action are to be found.

The distribution of the Navy embraces three questions relating respectively to ships, men and naval arsenals or head-quarters. Without entering into any discussion on the subject of naval architecture, I think I am safe in asserting that the nature of the ships to be employed, may be broadly divided into three classes:

1st. Those that are intended to take part in the combined action of a fleet.

2ndly. Cruisers.

3rdly. Port-defence vessels, floating batteries with motive power.

The disposition of these classes must depend upon the nature of the service to be performed. For instance, in the Channel and Mediterranean, we require the first description of ship, because combined action on the part of opposing forces, is what we have to expect: on more distant seas, danger would threaten our commerce and communications in the form of swift cruisers acting more or less independently, therefore to guard against their depredations, we must employ a similar class of ship. Port-defence-vessels are necessary to secure the majority of naval arsenals or depôts from bombardment from the sea, for this is a contingency for which, generally speaking, fortifications and land forces are no real provision. To leave the defence of the arsenals in the hands of the sea-going fleet, is to tie them up so far as other duties are concerned; and further, it would be in effect "to use the fleet to maintain the arsenals, instead of the arsenals to maintain the fleet." As regards men, the numerical limits are defined by the number and nature of the ships composing the fleet; and the resources of the naval arsenals must be proportioned to the requirements of the fleets of which they are the base.

Now if the fleets are to be distributed according to the interests they are to protect, it is necessary in the first place to ascertain the

distribution of commerce. I would therefore refer you to table A, in the Appendix, which gives sufficiently accurate information to answer our purpose. The next table, B, shows our commerce during the year 1867, arranged into districts, by which will be seen the "precedence," as it were, of oceans, seas, and certain portions of the Atlantic, determined by the total approximate value of articles "*en route*" to and from the United Kingdom during that year. It is as follows:—

- | | | |
|---------|---|----------------------------------|
| Channel | { | 1. Waters of the United Kingdom. |
| | | 2. North East Atlantic. |
| | | 3. South Atlantic. |
| | | 4. North West Atlantic. |
| | | 5. Indian Ocean. |
| | | 6. German Ocean. |
| | | 7. Mediterranean. |
| | | 8. Baltic. |
| | | 9. Pacific. |

Of these, the waters surrounding the United Kingdom, the greater portion of the Atlantic Ocean, the German Ocean, the Mediterranean, and the Baltic do not in time of peace require the presence of any force for the protection of trade. Next in importance is the South Atlantic. In time of peace a large force is not required in the interests of trade,—the number of trading ports *not* in the possession of civilized powers being comparatively small—not more than about £2,500,000 worth goes to or comes from such places in that ocean. The same may be said of the North West Atlantic. The Indian Ocean is next on the list, and here the presence of a tolerably large naval force is at all times essential to the welfare of our trading operations. Lastly, I would observe that in the Pacific a small force may be employed with advantage to our mercantile interests even during a period of profound peace.

The actual strength and composition of each fleet must ever be determined by the forces against which it may probably have to contend, and as it is only of the peace-distribution I am now speaking, these opposing forces are either semi-civilized or barbarous.

War with an *European* maritime power would directly threaten the most valuable portion of our mercantile field of operation, but so long as we command the Channel and Mediterranean, these powers are held in check; they are, as regards the rest of the world, more or less "blockaded." Under these circumstances it would not be necessary to increase to any great extent the number of our cruisers in the more distant parts of the globe. The constitution of *European* navies confirms this view, for as a rule the ships composing those fleets are better adapted to taking part in combined action than to cruising purposes.

But when we turn to the *United States* the whole aspect of the question is completely changed. Attack from this quarter on the Channel or Mediterranean is, to say the least, most improbable, nor is any serious demonstration likely against the northern part of the east Atlantic.* The north-west Atlantic is more directly exposed, but

* See Report of the Chief Constructor, U.S. Navy, 1864.

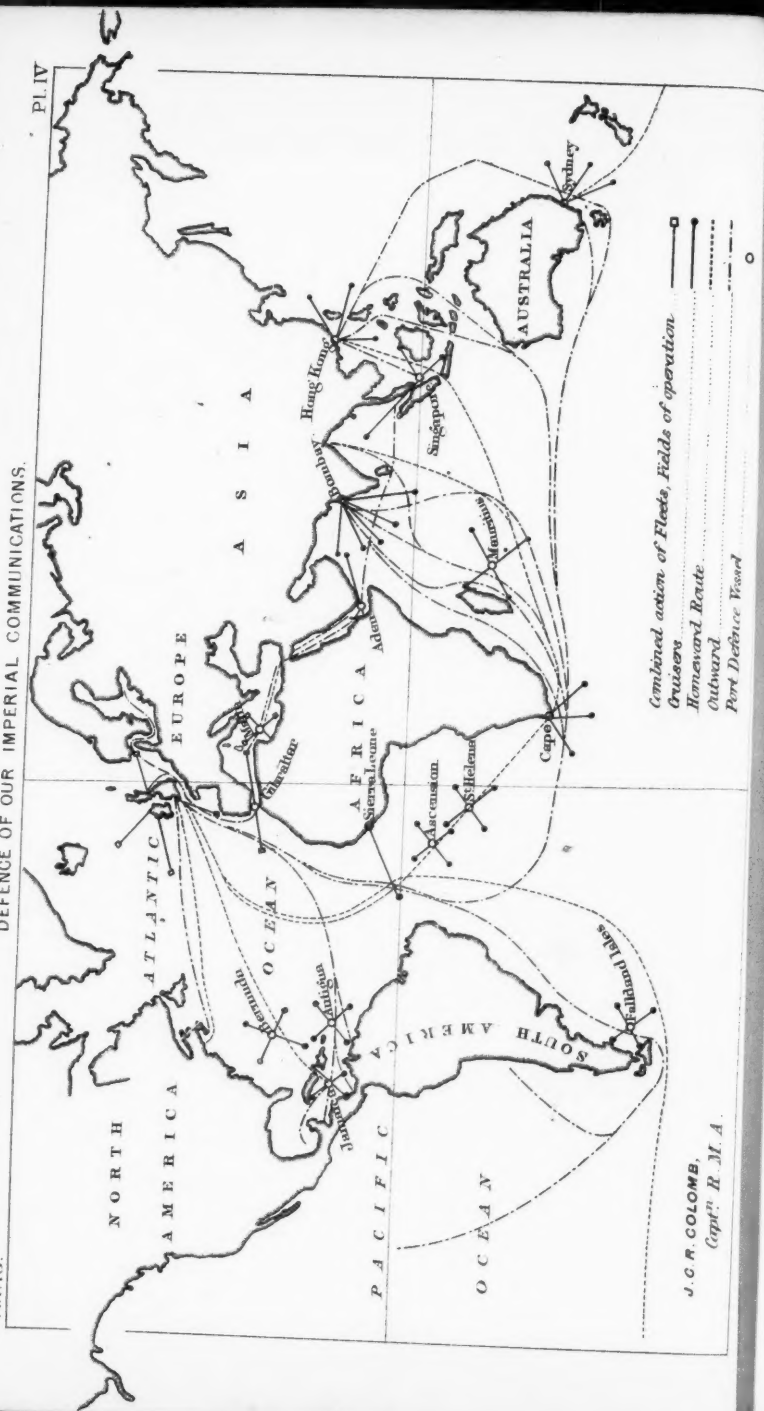
our commercial interests in that portion of the globe during such a war would be comparatively small. If we look at the composition of the American navy, and consider its past history, we find that it may be divided into two classes, one suitable to the purposes of defensive operations near its own ports, the other designed for the special and particular object of carrying on offensive and predatory warfare on seas far removed from its home; we may consequently, I think, conclude that the South Atlantic, the Indian Ocean, and the Pacific would be the principal scenes of action.

To summarize general principles of distribution so far as the protection of commerce is exclusively concerned, it may be said that during peace, force is only required, and to a limited extent, in the Indian Ocean, the Pacific, the South Atlantic, and part of the North-West Atlantic; during a war with European powers, our naval strength must be applied to the securing the Channel and Mediterranean; but should we be at war with the United States, the distant seas would demand our attention, and the protection of the Channel and Mediterranean would become an object of secondary importance. The principles of distribution of forces to meet the emergency of an European war are exactly the reverse of those adapted to the necessities which would be forced upon us by a rupture with America, they are also the opposite of those suitable to a proper provision for the protection of trade during peace. Our peace distribution would therefore only require expansion, were war unhappily to occur with the United States; but unless we are prepared to put a sufficient force into the Channel and Mediterranean, our peace arrangements would be valueless on the breaking out of war between us and any European power.

The districts into which I have divided the world are large, but they must be regarded as fields of operation, through which the lines of communication pass. It is now time to examine these more closely, and first, let it be remembered that they all find a common end in the Channel, therefore their general security can more easily be placed in peril by an attack upon that position. The nearer home the lines are cut, the more fatal would be the results. Our first duty then is to secure the Channel; our next object is to afford protection to the great roads, so to speak, leading to our most important advanced positions; these routes are—

1. To India and the East by the Mediterranean.
2. To India and China by the Cape.
3. To the West Indies.
4. To the Pacific.

In my last paper I said that "there are many places which, for the general welfare of the Empire, we must strain every nerve to hold against all odds." I will now name these. They are those points which occupy commanding positions on or near our lines of communication. For instance Gibraltar, Malta, Aden, and Bombay on the road to India; Ascension, St. Helena, the Cape, the Mauritius, Singapore, and Hong Kong on the route to China and the East; Antigua, Jamaica,



Capt.ⁿ R. M. A.

and Bermuda on the line to and from the West Indies; Sierra Leone, the Falkland Islands, and Sidney, are points of value to squadrons acting in the defence of the passage round Cape Horn. It requires no argument to establish the importance of the points on the Mediterranean route, but as the value of others may be questioned, it is desirable that I should give my reasons for selecting them. If we take a map of the Atlantic Ocean, and with a radius of seven degrees describe a circle, the centre of which is on the equator at the point 23° W., the track of nearly all vessels coming from or going to either the Cape or Cape Horn, will be found to pass through the space enclosed by its circumference, the greater number will be found near the centre. Now Sierra Leone is a port conveniently situated, with reference to that point, therefore, it appears to me desirable to consider it as an intermediate station, a place necessary to secure against seizure by an enemy. Ascension and St. Helena lie directly in the track of all vessels coming from the Cape. Vessels going to India after rounding the Cape have five passages open to them, which they take according to circumstances, three of these lie to the west of the Mauritius, and the other two to the east. The great highway of vessels coming from China and the eastern seas to Europe, passes about 5° or 6° to the south of the Mauritius, therefore I think this place may be considered as a point necessary to hold. Singapore is on the direct road from India to China, and with Hong Kong must be held. As regards the West Indian route; vessels, bound for the Greater Antilles or Gulf of Mexico, generally pass between the Islands of Guadaloupe and Antigua, those proceeding to ports more to the southward enter the West Indian seas between St. Lucia and St. Vincent. Antigua, possessing as it does good harbour accommodation, deserves preference as a base of operations for the windward squadron of the West Indian fleet. Jamaica is a good central position on the direct line of communication with Australia and the Pacific *via* Panama. Bermuda would be a place of great importance to our fleets during a war with America; it is not much out of the way of the tracks of vessels coming to England from the West Indies. Respecting the route round the Horn there is no choice, we must either dismiss the idea of having any fixed points near the line, or take the two I have named, the Falkland Isles and Sidney. My theory is that any point capable of defence near a line of communication is better than none, especially in this case where thousands of miles must be traversed before any other can be met with. The value of the Falkland Isles as a military outpost cannot be properly understood until we suppose them to be in the hands of America, for instance, with a defended anchorage and a powerful cruiser or two in the vicinity.

Indeed, there are two ways of looking at all the places I have named. We should not merely consider their value to us as military outposts and bases of operation for the force employed in keeping open the lines of communication, but we should also picture to ourselves the results likely to be produced, were they in the hands of our enemies. What, for example, would become of India, if Malta and Gibraltar fell into the hands of an European maritime power? What

would happen to our commerce and distant possessions were America to seize, as a necessary preliminary operation, all or any of the other points? and what is to prevent such a contingency in war, if it be not the adoption of well digested defensive measures?

They must, therefore, in peace be prepared for the part they would have to play during maritime war, and each naval station with its head-quarters so placed on the lines of communication, should have a distinct constitution and independent existence under one direction—that of its naval commander. Such constitution must be adapted to the requirements of peace, and capable of such expansion, as would become necessary when maritime war occurred. At his disposal should be placed—

1stly. A sea-going fleet for patrol duty at trading ports in his district, not in the possession of civilized powers.

2ndly. A small garrison for his head-quarters and for minor coast operations on other parts of his station, should such be necessary, together with supplies, stores, and means of repair. In war he must have a sea-going fleet equal to the task of keeping open his communications, a defended port, and a sufficient garrison to prevent the port being taken in reverse, with increased stores and means of repair.

The grand base of our naval operations throughout the world is the United Kingdom, but the enormous pressure which would be brought to bear upon our home arsenals on the breaking out of maritime war, points to the necessity of making Bombay a great reserve dépôt for war fleets in the Indian, China, and Australian waters. Having alluded to general principles, I will now attempt to draw the outline of distribution consistent with them.

Ships adapted for the combined action of fleets should be kept at home or in the Mediterranean. Cruisers adapted to war service should, if not in commission, be laid up in reserve at home ports, at Bombay, and at the head-quarters of the naval stations. Small vessels are best fitted for the protection of trade during peace. It would be a waste of force to employ powerful ships against semi-civilized or barbarous foes. These small vessels might be kept in repair at their squadron head-quarters, the war cruisers in reserve furnishing the means of transport, out and home, of the naval forces of the station; they would thus only be in reserve whilst their crews were employed in the heavy gun-boats. The number of port-defence-vessels required, is at present a matter of conjecture, but, in order to illustrate my plan of distribution, it is necessary to suppose some fixed number. I will therefore allow three for Malta, and, although Gibraltar cannot be seriously damaged by bombardment, it is desirable to secure the anchorage, and to have a small force localized in the Straits, therefore say two for that place, as also for the port at the Cape, Bombay, Singapore, Hong Kong, Jamaica, Antigua, and Bermuda, and one for each of the other dépôts—that at Sierra Leone being in reserve—26 in all.

Now, the sea-going ships for the Channel and Mediterranean service chiefly require good gunners and good stokers; but, as the use of sails is a valuable auxiliary, it is desirable they should be manned by seamen. Cruisers ought to be first-rate sailers as well as steamers, there-

fore they *must* be manned by seamen. To man the port-defence-vessels with seamen would be a total misapplication of the services of a class difficult to obtain, and urgently required elsewhere. Now these considerations affect to a considerable extent the internal distribution of our naval forces.

As port-defence-vessels would be incapable of leaving the headquarters of the station, it follows that when we are at peace with powers from whom offensive operations may be expected, the force employed in them is available for other duty, such as effecting repairs peace-garrisons, at the same time being ready for minor coast operations. If, therefore, the peace-garrison is composed of an auxiliary force to the Navy, all in excess of the complement required for the port-defence-vessels would be a real reserve for sea-going ships in time of maritime war. Now the Marine forces, composed of artillery and infantry, are exactly adapted to such service, and, on the other hand, such duty is exactly adapted to keep them efficient as a reserve for sea-going ships; there would be no charge for transport, as they would take passage, out and home, as supernumeraries in the men-of-war, and so learn their duties in those ships—the foreign service being limited to three years at a time. The complements of such vessels may be taken at 200 men, 50 of whom should be artillery, and 50 stokers. At each port there should be a coal depôt, the men employed for coaling might be organized and trained for stokers' duty in these vessels, forming a port-marine-militia attached to the regular force. If, therefore, we allow 50 artillery and 150 infantry per vessel, there would be really 50 infantry supernumeraries to each. But as the sea-going fleet in China must ever be considerable, 300 marine infantry, in addition to the force required for port-defence-vessels, might be quartered at Hong Kong. At Bombay an increased force of Marines would be well placed as a reserve either for the Indian or Mediterranean fleets. I will allow for that place 300 additional infantry. According to the foregoing calculations, 1,250 artillery and 4,350 infantry would be required for service abroad. This would leave under the present establishment, 1,810 artillery and 7,290 infantry at home, as an available reserve for the Channel and Mediterranean fleets, for which service they could be kept efficient by embarking recruits as supernumeraries for a short period during each year.

Now, as regards the Navy proper. I think it fair to assume as a basis of calculation, that we should be at all times prepared to place in the Channel and Mediterranean, a fleet double that of France, in order to allow for the contingency of combination against us. France has, I believe, in commission, ready in reserve or approaching completion, 60 iron-clads, carrying in the aggregate 786 guns. The complements of our iron-clads may be taken at about 25 per gun; therefore to man an iron-clad fleet double that of France in number of guns, we should require about 40,000 Officers and men. If we have, and are prepared to man, a fleet of that magnitude, our imperial base and the Mediterranean would be tolerably secure.

Next as regards the Navy of the United States.

Mr. Hamilton, late of the Confederate States' Navy, in his able

lecture* here last year said, "It needs no penetration to divine the future naval policy of the United States—it is to hold its coasts and harbours safe from blockade and attack With the coast secure, and the harbours open, the ocean is to be covered with a swarm of swift cruisers, and letters of marque." Now we require no preparation as regards letters of marque, but it is necessary we should be ready to meet the regular war cruisers of America. More or less adapted to the purpose, she could turn out 141 vessels, carrying in the aggregate 1,442 guns. The complements of our cruisers may be taken at, say 20 per gun—therefore to man a cruising fleet equal to hers, we should require about 29,000 officers and men—*these should be seamen*. As I have shown that in the unhappy case of a war with America, the Channel and Mediterranean are not directly exposed to attack, a large proportion of the 40,000 retained near home for European service would be available for duty in our war cruisers. By sending overland the number required for ships in reserve at Bombay, the Indian Ocean could be secured almost as soon as the Atlantic. The forces in the smaller vessels composing our peace squadrons abroad would at the same time turn over to the heavy cruisers in reserve at their headquarters. Thus might our peace distribution be expanded. To meet the exigencies of an European war, the concentration at or near home of our naval forces, is absolutely necessary, while such an arrangement can without difficulty be adapted to the contingency of a war with America.

The force provided for the service of our fleet and coast guard (exclusive of Marine forces) for the year 1868-9 was 52,070—from this number the following deductions must be made:—

3,100 untrained boys.

1,270 complements of Indian troop ships.

Leaving a balance of 47,700 officers and seamen disposable. I count the Coast Guard as part of the Channel Fleet in reserve. Assuming the Marine force to be distributed as proposed, the number of that force likely to be always ready for service in the Channel and Mediterranean Fleets is a fair set off against the above deductions, and therefore leaving untouched the 40,000 for these fleets, we have 12,000 Officers and seamen available for the protection of trade in peace, enough to man 80 vessels with average complements of 150 per vessel. Considering that all civilized nations are deeply interested in the safety and security of trading operations during peace, and that this number nearly equals the total fleet of America at present, I presume it may not be considered too small. It would not be desirable to reduce our peace squadrons to a very low standard, because such employment is necessary for training both officers and men. This purpose would be more fully answered by the proposed distribution of Marine forces; so many Marines might annually be embarked for a trip round the station—a corresponding number of seamen being disembarked for the purposes of discipline and in-

* See paper on "The American Navy; its Organization, Ships, Armament, and Recent Experiences," by J. Randolph Hamilton, Esq., late Confederate States' Navy.—Journal of the Royal United Service Institution, vol. xii, No. 49.

struction on shore, and still there would always be available labour for repairs, &c., at each head-quarters. In order to illustrate the general outline of distribution proposed, I have drawn up Table C. I have taken the average complements of war cruisers at 500, those for peace at 150. It would be inconvenient, involve unnecessary expense, and needlessly absorb many men, were there a large number of war cruisers in temporary reserve at each head-quarters, therefore, three is the maximum I have allowed; supposing war to occur, the peace squadrons would be called in to their respective head-quarters, their crews turning over to the war cruisers. At Hong Kong 3,000, and at Singapore 250 would still be disposable, and would proceed to Bombay to man the vessels there in reserve. Aden and the Mauritius would require 50 to complete, but the marine supernumeraries would temporarily meet the difficulty until further reserves arrived. At the Falkland Islands there would be a large excess, on the coast of Africa a deficiency, but by detaching two peace cruisers from those Islands to the Cape, the war cruisers there might be fully manned. Each squadron might still retain a small reserve of seamen in addition to its final Marine Reserve. As there is no head-quarters for the Pacific Squadron, I suppose cruisers of the heaviest class to be always on that station. I here wish to observe, that all my tables are merely for the purpose of illustrating general principles. I do not presume to fix the number required for the protection of commerce, nor the force necessary for each station. I take 12,000, because it happens to be the balance remaining after deducting 40,000, the number I suppose to be required near home. If 12,000 Officers and seamen are employed abroad, the number remaining for Channel and Mediterranean service, and Coast Guard, would be 35,700. France has I believe actually in commission ironclads carrying 300 guns, to double her peace fleet; we may suppose 15,000 officers and seamen to be actually employed in our Channel and Mediterranean Fleets. The Marine Infantry being disembarked from the Coast Guard ships, would leave vacancies for some 1,200 seamen, bringing the Coast Guard service up to nearly 9,000, leaving about 11,700 officers and seamen available for service, either in effective sea-going ironclads kept for harbour duty, or in barracks—this would be our first, the Coast Guard the second, the Marines and Marine Artillery at home, the third Reserve. The whole distribution of our naval forces would then be as shown in Table D.

The proportion of home to foreign service for the Navy proper would be about the same as that for the marine services.

I propose to exclude the marine forces as part complements of sea-going ships in time of peace, for these reasons:—

1st. Because so employing these auxiliary forces leads to the exclusion, from participation in the active duties of their profession, of a corresponding number of naval Officers and seamen, at present about 8,000.

2ndly. If any real necessity for so employing the marine forces exists, it is because the Navy has not barracks, opportunities of instruction and a proper organization, therefore it would be resting any

plan of distribution on a false basis to assume that such a state of things is to be considered a permanent institution.

3rdly. Because by distributing them as proposed, their efficiency as a reserve for service at sea would be fully maintained, that of the artillery as a gunnery reserve, that of the infantry might be increased, for by its employment at the various places where temporary repairs were effected, it would in time become a corps of combatant naval artificers. Whenever there was fighting to be done, the marine forces would still be ready to hand on each station, and a large force would be at home ready for big or little wars, for service ashore or afloat.

It may be plausibly asserted that if it be possible to dispense with the services of the marine forces, as part complements of men-of-war, these forces are no longer required. But be it well remembered that the seaman's profession is a marketable trade, that of a marine artilleryman or marine is not. The merchant navies of the world bid high for British seamen, the demand constantly increases, the supply continues to diminish, therefore a naval auxiliary force not affected by inducements which create constant fluctuations in numbers available, is essential to the very existence of a large Navy.

The advance in mechanical appliances and the increasing scarcity of seamen, will add year by year to the value of this description of naval force, but to my mind it should not be employed to the exclusion of seamen, it should be held in reserve and kept efficient by other means during peace. At present about one-seventh of a ship's complement is composed of marine artillery and marines, in the event of a sudden increase to the fleet being necessary no seamen could be spared from the ships in commission, on the other hand if the marine forces are kept efficient in the way proposed, and by attaching them as supernumeraries occasionally to sea-going ships, the complements of which are entirely composed of seamen, the fleet could be expanded by one-seventh at any moment. It would be always advisable to keep a large proportion of the marine force at home to provide for the eventuality of a great maritime war, when the complements of additional ships would necessarily be composed of untrained and undisciplined men, entered hastily for service in the fleet.

We now come to that part of the question which has special reference to the Army.

In the case of Ascension, St. Helena, the Falkland Islands, and Sidney, the detachments of marine forces would be sufficient peace garrisons, but the other points would require additional force.

The quartering of the British Army for a long series of years at places like Hong Kong, Singapore, Mauritius, Aden, and the West Indies, is fatal to health, and consequently to efficiency, and results in loss of valuable life and vast expense for transport. There is no variety, no change from the monotony of a listless garrison life at such places. While advocating the withdrawal of our regular British Army from such duty, I do not suggest to replace it by increasing the number of the regular marine forces already proposed to be quartered at those points, because such an arrangement would merely shift the disadvantages from the Army to the Marine services. It would be

impossible to keep large bodies of marines efficient as a naval reserve, unless the Officer commanding the station had a very large sea-going fleet at his disposal. Where the forces of marines at a naval head-quarters exceeded the means of instruction afforded by the sea-going fleet, the power of giving instruction, change and variety by occasional embarkations for a trip round the station would be lost; this would lead to disease and impaired efficiency in the marine garrisons; we must look elsewhere to meet the difficulty. Bombay being the supposed head-quarters of our fleets in the Indian seas, I would propose a native marine force being raised, with its head-quarters at that place. It would not be necessary to use these troops for service at sea, but merely for garrison duty, and furnishing available labour at Bombay, the Cape, Mauritius, Singapore, Hong Kong, and Aden. The regular marine forces would be the European nucleus to which this native force with a similar organization would be attached. They would take passage from and to Bombay in the war cruisers, and the term of service away from that place would be the same as that of the regular forces, viz., three years. This force should be under the control of the Admiral commanding at Bombay.

Now, this arrangement would meet many of the difficulties brought forward in the report of Major Anson's Committee. It would be a military force, used for military purposes, but under naval control.

The West Indian regiments would, in the same manner, be formed into a West Indian marine force. Thus, in time of peace, the Naval Officer commanding on each station, occupying a fixed position at his head-quarters, would be the one military executive authority responsible for the preservation of internal order at his head-quarters, with a fleet and military force at his command for the repression of disturbances in any part of his district. In war his place should be at sea, the marine forces would defend his port from bombardment, and the security of the naval bases of operation throughout the world would devolve upon the Army, till then, necessarily held in reserve. I say necessarily held in reserve, because we know not from what quarter we may expect attack. It may be of a nature requiring all our strength to be put forth at home, it may more directly threaten India, or it may have for its object the gradual exhaustion of our commercial and military strength by the cutting off our lines of communication at distant points. For each and all of these contingencies we must be prepared. Now, if the Army be employed at detached points all over the face of the globe, and circumstances required its presence at home or in India, how much time would be lost before it could receive its recall? Add to this the time it would take to return, and estimate the consequences of delay, if you can! On the other hand, the declaration of war by a power from whom assault on distant possessions might be expected, would be the signal for the despatch of troops ready at hand to the succour of the garrisons along the lines of communication. Having so taken up a proper defensive position, we could then, under cover of our fleets, develop our resources, and use these defended points as bases of *offensive* operations, from which flying brigades drawn from the manœuvring army of the empire might act either in the defence

of our possessions in the vicinity more immediately threatened, or for the purpose of creating a diversion in favour of others by retaliation against those of our enemy. Jamaica, Antigua, and Bermuda might thus be applied to the defence of the West Indies, or to the relief, however small, of "Canada."

This brings us back to the point from which I started in my first paper—home distribution. We must view the regular military forces in the United Kingdom from three distinct points of view, as reinforcements for India; as a reserve for Mediterranean garrisons; and as the war garrisons (in reserve) for naval head-quarters throughout the world.

For India we require a manœuvring or field Army, and a contingent for garrisons at fortified points; but for the defence of the Mediterranean and all our other out-posts, we should want only a "garrison army," a body of troops trained and adapted to the defence of fortified positions. In my first paper I supposed the foreign service of the regular Army to be limited during peace to India, Aden, Malta, and Gibraltar,* thus bringing the number at home to about 126,000, and I divided the reserve forces for the defence of the United Kingdom into two parts—garrison and manœuvring. I now go a step further, and divide the regular military forces for the defence of the Empire into two branches—garrison and manœuvring.

As regards the first branch, hostilities which would require our small and distant out-posts to be placed on a war-footing would not likely directly threaten the United Kingdom, or the Mediterranean, but any war which would lead us to expect attack at home, would necessitate our filling up the garrisons of Malta and Gibraltar; in either case, a large garrison army would be required.

As our distant out-posts are as yet undefended, it is impossible to estimate for their war garrisons, but, for reasons already given, I balance the force necessary for that purpose against that required for home and Mediterranean fortresses. I assumed that at the moment of expected attack, *one-third* of the total garrisons of fortified places at home should be regular troops; that would be about 22,000 (exclusive of Cork harbour, and Alderney, which would require about 2,000 more), I believe 30,000 may be taken as the lowest estimate for Mediterranean garrisons under similar circumstances; therefore, our total regular garrison army should not be less than 54,000. I take the following general principles as a guide in distributing this force:—

1st. The head-quarters of the forces intended for the defence of fortified places abroad, should be fixed at the fortified places at home,† in order that they may be trained to the peculiar nature of the duty they would have to perform in war.

2nd. The strength of the garrison army so quartered in the United Kingdom, should be such as would permit of its furnishing the force required to raise the garrisons of Malta and Gibraltar from a peace to a

* India, 64,000	
Aden	} 10,000
Malta	
Gibraltar	

† For detail, see Part I.

war footing, without reducing the number of regular troops in these home fortresses below the number necessary for their own defence.

It would occupy too much of your time, were I to go closely into details relative to each defended point, and therefore I shall deal with the subject of barrack accommodation in a very general and rough way.

At the end of the Report of the Defence Commission, you will find that the works proposed and in progress for the defence of these places were estimated to accommodate about 30,000 men, to this must be added barracks actually in existence which may roughly be computed to hold 18,000,* therefore supposing the works to be completed, there would be room for about 48,000. I proposed to raise the Mediterranean peace garrisons from one-third to one-half the total estimated war garrisons, thus bringing the force quartered there in peace to 15,000. Further, as barracks are a great naval want, I propose to give up accommodation for 8,000 of the first reserve at Chatham, Portsmouth, and Plymouth, the money which would otherwise probably be devoted to building naval barracks, being applied to the construction of quarters elsewhere for the "Manœuvring Army." Under these circumstances the garrison army at home would number 39,000, and there would be quarters for about 40,000. It will thus be seen that the garrison army could be localized at these fortresses—the defended points at home would be the great feeders of all our fortified positions abroad, and in turn be fed in Great Britain by the Reserves in the surrounding districts, they would in fact be the great Artillery and Engineer centres both regular and reserve.

In Table 2 (Part I) you will see that 16,921 is the number of Militia in the counties I have grouped together to furnish the Reserves for these fortresses; under the proposed distribution 15,000 regular troops would move from thence to the Mediterranean when danger appeared, therefore by calling out the Militia at their fixed head-quarters, the vacancies so caused would be completely filled.

Whether the garrison army, regular, and reserve, should exclusively consist of garrison Artillery and Engineers, or be partly composed of Infantry, always associated with or attached to these scientific branches for the performance of minor duties is a question of organization, not distribution, but I remark in passing, that so far as I have been able to ascertain, our regular garrison Artillery, even, if withdrawn from colonial service, could only furnish for home and Mediterranean fortresses about two men per gun, if so many.

Now, as to the distribution of the regular "Manœuvring Army" at home. Under all the supposed circumstances it would number about 82,000 Cavalry, Field Artillery, Infantry, Train, and Staff. For reasons given in the first paper, I do not attempt to deal with the internal distribution of regular forces in Ireland—the number to be employed depends upon circumstances of a political character. As, however, it appears by Appendix K, p. 26, to the Report of the "Commission of Recruiting," that about one-fifth of the total number of recruits for the line during the five years ending 1865, was raised

* Marine barracks not included.

in Ireland, 20,000 men may be considered a fair proportion to fix for service in that country, thus making allowance for the necessary deductions on account of the force in India and the garrison army. This number at all events will answer the purpose of illustration, and there is I believe ample accommodation there for that number.

Sixty-two thousand now remain disposable in those divisions of Great Britain furnishing the Reserves for the Manœuvring Army, as explained in my first paper. This would allow an average of about 5,000 regular troops to each division so formed, but the exact number to be allotted to each, however, would depend upon a variety of circumstances—the strength of the regular Reserves, for example—which I do not now intend to enter upon in detail, but I will sum up as regards barrack accommodation for the Manœuvring Army in Great Britain in this way. Within the limits of that part of Great Britain which I have allotted to the Manœuvring Army, there is barrack accommodation for about 37,000 men, including Aldershot, which is the head-quarters of the First Division, though situated in one of the counties of the Portsmouth district; therefore under the supposed arrangement, quarters would have to be provided for 25,000 men; but I remind you that this proposed distribution provides barracks for the Navy, and reduces the annual charge for transport of troops by about £250,000 per annum, which represents £5,000,000 at 5 per cent., and this sum would build barracks according to the Defence Commission estimate, for 50,000 men.

I would propose to build these barracks at the head-quarters of each *Brigade District*, in order that the Militia might have the use of them.

One of the recommendations of the Militia Commission of 1859,* was that the Militia forces should be “trained annually,” and, if possible “simultaneously.” Now it would be possible to apply that principle not only to the Militia, but to all our war forces at home, and so make one branch check the other, and all rehearse the business of defensive war in the spring time of each year.

The first force to move out to face an enemy must ever be—the Navy, therefore the 8,000 seamen should embark each year in the reserve ships for Channel service, the militia of the garrison army moving into their barracks; in like manner a portion of the marine barracks could also be made available for the reserves. The regular troops of the Manœuvring Army quartered at the brigade head-quarters should move to the divisional head-quarters and encamp, the militia moving into the barracks thus vacated, and during the last week of training, join the regular troops of their division at the temporary camp, thus leaving barrack accommodation vacant for other reserves of the district. If there were no reserve ships ready, there would be no barracks vacant for the garrison militia; if camping arrangements were not in working order, the training of the manœuvring militia would come to a dead lock; thus would one department check the other.

I have carefully avoided touching the subject of “organization,” for that is a thing entirely subservient to “distribution.”

* See Blue Book.

We are apparently on the eve of great changes, and therefore it is essentially necessary that we should not lose sight of the end—"the safety of the Empire"—for which our war forces exist. In this room last year it was truly stated,* as a principle that "it is wiser "to concentrate the resources of a country on the fortifications "of the principal arsenals, so as to secure them against capture, than "to expend the same resources on many comparatively unimportant "points which, from their isolation and weakness, invite attack and "afford cheap victories." Now, viewing the whole Empire as a country exposed to attack, it may be said that it would be better to turn our resources to the purpose of securing points that command our communications, than to fritter them away in attempting to defend a variety of unimportant positions. How far we have hitherto acted upon this principle may be gathered from the fact that the estimated imperial military expenditure upon our colonies and dependencies for the year 1864-5 amounted to about £3,500,000, and of this sum only about £1,300,000 was expended upon the outposts I have named. Now if these positions are lost to us, the safety of our communications is gone; that being the case we could do little to assist any of our distant possessions in time of need. Why then expend nearly two-thirds of our available resources upon unimportant points which would afford cheap victories, whilst but one-third is spent upon positions the loss of which would involve the whole Empire in a state of commercial and military paralysis? As regards the United Kingdom (the citadel of the Empire), let it never be forgotten that we have two dangers to guard against—direct assault, and investment, partial or complete. Though these islands may bristle with bayonets, though at the very name of invasion millions of riflemen may be ready to line the hedge-rows, let us not shut our eyes to the fact that our supplies might be cut off, that we could be, in short, starved out. Therefore must our war forces be distributed in such a manner as will best secure the imperial base of operations, and ensure safety and freedom to our imperial communications.

* See lecture before referred to.

APPENDIX.

TABLE A.

DISTRIBUTION of British Commerce.

Approximate Value, 1867.

	£
Ports on Baltic	38,000,000
„ North Western Atlantic.. ..	100,000,000
„ Round Cape of Good Hope ..	91,000,000
„ German Ocean	81,000,000
„ North East Atlantic	66,000,000
„ Mediterranean	66,000,000
„ South Atlantic	27,000,000
Round Cape Horn.. .. .	31,000,000
	<u>£500,000,000</u>

TABLE B.

TABLE showing approximate value of Articles *en route* to and from the United Kingdom, over certain divisions of the Atlantic Ocean, 1867.

To and from Ports.	Waters in United Kingdom.	North East Atlantic.	Southern Atlantic.	North Western Atlantic.
	£	£	£	£
Baltic	38,000,000			
German Ocean.....	81,000,000			
North Eastern Atlantic ..	66,000,000	66,000,000		
Mediterranean	66,000,000	66,000,000		
South Atlantic.....	27,000,000	27,000,000	27,000,000	
North West ditto.....	100,000,000	100,000,000	..	100,000,000
Round Cape Horn	31,000,000	31,000,000	31,000,000	
„ Cape of Good Hope	91,000,000	91,000,000	91,000,000	
	500,000,000	381,000,000	149,000,000	100,000,000

TABLE C.
Peace Distribution, exclusive of Channel and Mediterranean.

Grand Base.	Station.	Squadron Head Quarters.	Port Defence Vessels.	War Cruisers in Reserve.*	Peace Cruisers.†	Officers and Seamen.	Port Defence, &c.		Surplus.	Deficiency.
							Artillery.	Infantry.		
Bombay	China.. ..	Hong Kong ..	2	3	30	4,500	100	600	3,000	
	East Indies	Singapore ..	2	1	5	750	100	300	250	
		Aden ..	1	..	3	450	50	150	..	50
	Australia ..	Mauritius ..	1	..	3	450	50	150	..	50
		Sydney ..	1	1	4	600	50	150	100	
United Kingdom	Coast of Africa	Cape ..	2	2	3	450	100	300		
		Ascension ..	1	1	5	750	50	150	..	300
		St. Helena..	1	1			50	150		
		Sierra Leone ..	1	In reserve.			50	150		
	S. E. Coast of America..	Falkland Islands	1	1	6	900	50	150	400	
	West Indies	Antigua ..	2	1	4	600	100	300		
		Jamaica ..	2	1	4	600	100	300	150	
		Bermuda ..	2	1	3	450	100	300		
	Pacific ..	.. ..	..	3	..	1,500	100	600		
						Bombay ..	100	600		
							12,000	3,600		

* Average complement taken at 500.

† Average complement taken at 150.

TABLE D.
DISTRIBUTION OF NAVAL FORCES.

	Officers and Seamen.	Marine Forces.		Totals.
		Artillery.	Infantry.	
On distant Stations	12,000	1,000	3,600	16,600
Malta .. ..	.. ..	150	450	600
Gibraltar .. ..	.. ..	100	300	400
In Peace Fleets .. ..	.. ..	.. ..	.. ..	.. ..
Channel and Mediterranean ..	15,000	.. ..	.. ..	15,000
At Home Arsenals	11,700	1,810	7,290	20,800
Coast Guard	9,000	.. ..	.. ..	9,000
In Indian Troop Ships	1,270	.. ..	.. ..	1,270
Untrained Boys	3,100	.. ..	.. ..	3,100
Total ..	52,070	3,060	11,640	66,770

Present Establishment (1868-9) 66,770.

Ebening Meeting.

Monday, February 1st, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES OF MEMBERS who joined the Institution between the 18th January and the 1st February, 1869.

ANNUAL.

Acton, E. W. F., Capt. 1st Roy. Cheshire Mil. 17.	Innes, J. M. McLeod, U.C., Major Roy. Engrs., Bengal. 17.
Sayer, J. R. S., Col. Asst. Commt., Cav. Depôt, Canterbury. 17.	Thackeray, E. T., U.C., Capt. Roy. Engrs. Beng. 17.
Studdert, R. A. Fitzgerald, Capt. Lond. Art. Vols. 17.	Ready, John T., Capt. 66th Regt. 17.
Wilson, Charles W. H., Capt. 6th The Royal Regt.	Stephens, Edmund, Lt. Roy. Engrs. 17.
Cockburne, James G., Capt. 6th The Royal Regt.	Henderson, W. Hallam, Lieut. Royal Engrs. 17.
Harrison, Thomas P., Capt. 107th Regt. 17.	O'Brien, E. D. C., Lieut. Roy. Engrs. 17.
Gordon, Robert W. T., Lieut., 93rd Highrs. 17.	Wallace, Charles J. S., Lieut-Col. 25th K. O. Borderers.
Trotter, Henry, Lieut. Roy. Engrs. 17.	Ruddell-Todd, James A., Major 25th K. O. Borderers.
	Scriven, Horace W., Capt. 25th K. O. Borderers.

RECOIL DELICATELY CHECKED AND UTILISED.

By Lieutenant-General W. N. HUTCHINSON.

Read by Captain ROBERT SCOTT, R.N.

THE increasing power of resistance constantly added to defensive armour gives a proportionately increasing importance to ordnance throwing heavy charges, and bespeaks a careful consideration of any proposed improvement in the principle of checking recoil, for it is well known that the range and efficiency of powerful guns are much diminished from the inability to fire as large charges of powder from them as would be practicable, were it not for the evils arising from the great recoil occasioned by large charges. In August, 1863, the Ordnance Select Committee reported "that wrought iron guns might

“be made lighter than they are, or be used with heavier charges, if “the recoil could be more effectually checked.” The present proposition for more efficiently checking recoil is by the use of the most elastic and inexpensive cushion known, viz., the common atmosphere, which can be employed in the most delicate, yet effective manner, and to any amount.

The application is by the use of a closed cylinder, with a piston and rod working in it, having much air on one side of the piston, and very little on the other (see Plate v, figs. 1 and 2).

When recoil takes place, the piston is forced into the part containing the greater body of air, which is thereby compressed, while at the same time the air on the other side of the piston is proportionably rarefied. The increasing resistance of the air thus gradually and quietly receives and absorbs the force of the blow from recoil. This smooth absorption of recoil allows of the employment of a gun much lighter than the ordinary gun, supposing the weight of powder and shot to be the measure of the similarity in both.

To utilise the rebound that would instantly occur from the elasticity of the highly-compressed air, a self-acting catch (or other contrivance) retains the gun (with carriage) in its back position until loaded; then, when the catch is released, the pressure of the compressed air against the piston most usefully assists in running out the gun to firing position.

With very light guns (which are particularly desirable on turntables) when very heavy charges are fired, the air will be more compressed by recoil than is required to return the gun to firing position. This stored-up-force can be smoothly eased off by means of a light hand-rope rove through double-sheaved pulleys, or be controlled by means of a friction band, &c. But were all precautions neglected little inconvenience could arise; for the air that had been rarefied at one end of the cylinder, becoming in its turn gradually compressed as the gun resumes its firing position, would act as a soft cushion, and prevent mischief at the termination of the rebound.

Fig. 3.—When a gun is mounted on an ordinary carriage, the cylinder, constructed as shown in Fig. 3, is attached to the carriage below the gun, not far from the trunnions. The piston-rod lies nearly horizontal in a vertical plane with the axis of the bore, the exterior end of the rod being towards the muzzle. This end of the rod plays freely in a ring (or circular staple, or eye) fixed below the sole of the embrasure or port-hole. Thus the free training of the gun is not in the least impeded. When the gun recoils, it carries the cylinder with it, compressing the air in front of the almost stationary piston. All the force of the recoil is thus absorbed without friction, and without causing the least jar or strain to any part of the carriage or platform, for it is obvious that all the horizontal strain is borne by the ring.

For the sake of security this ring might play in the angular part of two strong iron bars joined together in the form of a letter V, running for many feet horizontally through the parapet. To the extremity of these bars would be attached large flat bars or beams, fixed crosswise and vertically in the body of the parapet.

SKETCHES.

Fig. 1.

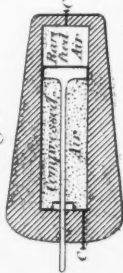


Fig. 2.

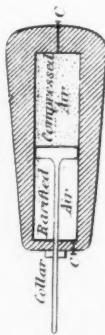


Fig. 3.

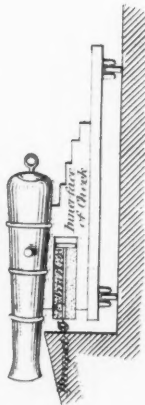


Fig. 5.



Fig. 6.

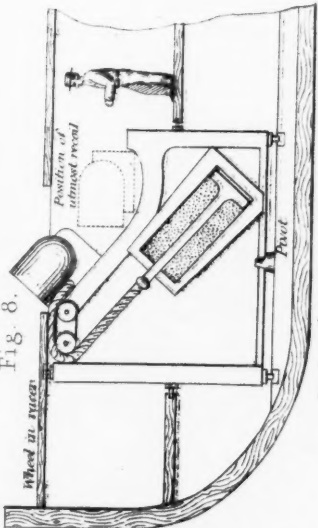


Fig. 4.



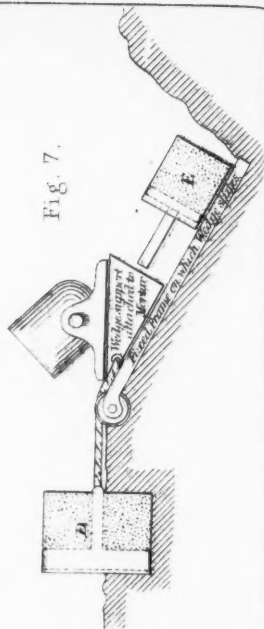
Part of
Mortar Carriage
7 inch Gun.

Fig. 8.



Section through a Mortar Boat

Fig. 7.



In applying the cylinder, made according to Fig. 1, as a substitute for the weight in Moncrieff's carriages, it would be firmly attached to the after-part of the traversing platform.

A flexible rope (passing over a pulley, fixed vertically, in the front and lower part of the platform), would be attached to the exterior end of the piston-rod, and would connect it with the centre of the horizontal cross-bar which unites the front extremities of the toothed segments constituting the sides of the carriage. The rope intervening between this cross-bar and the end of the piston-rod would be about the length of the rod, which would be the measure of the limit of recoil.

Recoil would cause the trunnion-ends of the segments to roll inwards with the gun, and sink below the crest of the parapet,—the too sudden elevation of the other ends being, soon after starting, gradually more and more resisted by the gradually increasing density given to the air by the rope pulling forward the piston.

The cylinder, if sufficiently increased in diameter (therefore in power), need only be half the described length, were the rope, when fastened to the front of the traversing platform, to be passed through a pulley fixed at the exterior end of the piston-rod before it passed over the other pulley.*

By a little alteration of the disposition of the parts which connect the sides of most gun-carriages, ample space would be found for the proper adjustment of the cylinder.

Marks on the rod would show at all times the exact position of the piston within the cylinder.

C, C, C, C, are air-cocks occasionally turned to allow the entrance or escape of air, and thus regulate to the greatest nicety the resistance to be given by the compressed air, and the length of the stroke of the piston. It is clear that the less the air is admitted into the vacuum-end of the cylinder the greater will be the resistance of the compressed air, and consequently the less will be the length of stroke, and the less the length of recoil. This principle of checking it, gives such absolute control over the gun, that all rapidity of recoil might be prevented *ab initio*. By bringing the piston home to the head of the cylinder there would be practically a perfect vacuum at that end, when the gun's starting to recoil would be resisted by a pressure exceeding 14 lbs. per square inch of every inch of the piston's area, even should the cylinder be only charged with air of natural density.

Were there any advantage in the arrangement (which is doubtful), any greater resistance at starting could be made uniform during the whole of the recoil by means of a safety-valve placed at the end of the cylinder, whose spring would more and more yield to the escape of air as its pressure increased. It must be obvious that were the end quite open, the pressure might always be 14 lbs. to the square inch, both for resisting recoil and for running out the gun.

* When cramped for space, instead of the compressed-air end of the cylinder being closed in the usual manner by having a globulous reservoir attached to the sides near the end, and the lowest part of the sides thus encased pierced with holes communicating with the reservoir, the piston might be driven home the full length of the cylinder.—W.N.H.

It has been suggested that there would be danger of leakage of air were the gun retained for hours in the loading position,—but manufacturers will assure you that with careful workmanship, there need be no apprehension on that score. The motion of the piston is slow. The pressure of the condensed air, unlike that in a steam-cylinder, is always on one and the same side of the piston, therefore the compressed air is constantly forcing the soft, well-greased packing into any crevice that might otherwise exist between the uppermost plate of the piston and the side of the cylinder. Moreover, the collar round the piston-rod being always in the air of greatest density (inside the cylinder, Fig. 1, outside the cylinder, Fig. 2), is always pressed against the piston-rod, which prevents any escape in that part,—but were there even a slight escape, it could readily be replaced by the air-pump.

In the two foregoing instances of recoil being checked, it was resisted by the piston-rod being partly drawn out of the cylinder, but in the case of wall-pieces and all arms fired from the shoulder, the force of recoil could be met by the piston-rods being driven into the cylinders (see Fig. 2).

The stocks of such pieces would be in two parts. To the shoulder-plate a small cylinder made on the principle shown in Fig. 2, is fixed within the stock. The part *A* slides within the part *B*, see Fig. 5. The two parts are usually together, as shown in Fig. 6. Recoil drives *A* (say an inch, or inch and half) close to the shoulder-plate, the force of the blow being received on the piston; then *A* returns, by the force of the rebound, to its usual position. Rifled wall-pieces with steel pointed projectiles were much employed by the Americans in their last war, and from their range, precision, and penetration, are likely to be frequently used in future to resist approaches by sap, &c., especially as the adoption of the cylinder would allow of pieces of increased power being manufactured. Only sap gabions of unheard-of diameter could resist penetration from such pieces.

The decks of iron-clads being their most vulnerable point, many think that mortars will be much used in future. It is clear that any arrangement which would admit of their recoiling, would greatly augment their power by allowing larger charges of powder being employed than can now be used. It is believed that no attempt has as yet been made to attain this desirable end, but endeavours have been made, by supporting the beds of mortars on vulcanized india-rubber, to lessen the injurious strain given to a ship on their being fired. These attempts failed, principally from the constant weight of the mortars destroying the elasticity of the india-rubber.

It is now proposed (see Fig. 7), where a traversing platform may not be required, that the carriage shall be somewhat in the form of a wedge,—that on the mortar being fired, it shall recoil or slide downwards (towards the fixed cylinder *E*, and from the fixed cylinder *D*) on a wooden platform lying at such an inclination that the carriage will not slip down, but remain in the highest position until the mortar is fired,—that, after recoil, the carriage, with mortar, shall be retained by a catch in the lowest position (where the gunners will be sheltered) until it be re-loaded,—and that on being released by freeing the catch,

the force of the compressed air shall aid the gunners in making it re-ascend. Of course the wheels of the carriage will always self-lock during the descent. Few easier plans could be adopted for effecting this lock than the falling weight on a cogged wheel, as employed in a ship's windlass.

Where it would be inconvenient to place cylinders of such a size that air in its natural state would give sufficient resistance, the power of both the cylinders might be increased by their being charged by an air-pump (attached to the air-cock), with air of the requisite density, as indicated by a gauge.

As there would always be ample space for D cylinder, it could be made of whatever size and power* might be required.

It is hoped that Fig. 8 will give a sufficient general idea of the arrangement proposed when it is necessary that the recoiling-mortar should stand on a revolving platform. In a mortar-boat, a circular hole (say 7 feet in diameter) is cut in the upper deck, also in the lower. The inclined beams that support the carriage and mortar rest on a revolving frame standing on wheels, which travel in a circular groove attached to the bottom of the boat. A projection (terminating in a wheel) from the upper part of the revolving frame prevents its lifting or receding when the mortar is fired. That wheel plays in a circular groove fixed underneath the upper deck, near the edge of the hole cut in it. Against the edge of the lower deck (through which the revolving frame passes to the bottom of the boat) is also a racer in which work horizontal wheels to further steady the frame in a sea or during firing. The skids (or rails) on which the carriage glides are curved upwards towards their lower termination, to assist in checking recoil.

In pits on shore, or wherever additional weight would not be disadvantageous, a counterbalancing weight to the mortar might be substituted for the cylinder.

Some naval men think that the adoption of a few mortars in our iron-clads would much add to their efficiency. If the shells projected, were made to rotate rapidly in the plane of their progress, they would gain in precision and penetration. This, it is believed, could be effected on the principle shown in the wooden model of a 32-pounder disc-gun, now in this Institution, and which was fully described in a paper read here on the 4th of February, 1867.†

The shot on starting is tripped, as it were, by a fixed steel catch, which fits into a notch, or small hole cut on the surface of the shot. This causes the shot actually to spin during its flight, and when alighting on level ground to roll rapidly for a long time in the direc-

* Of any power. The undersigned took out a patent, dated 1st February, 1864, for "Improvements in the construction of Cylinders of Hydraulic Machines, applicable also to the construction of ordnance and other articles, or vessels subject to "pressure from within." It explained how in a cylinder composed of many consecutive tubes, each tube could be made to do as much useful duty as the innermost, in resisting a bursting strain, by a calculated pressure given to the mercury (or any fluid) that slightly separated the several tubes.—W.N.H.

† Printed in No. 43 of the R. U. S. I. Journal, vol. xi.

tion of aim. On striking an object, the force of the blow received is the resultant of the horizontal trajectory and of the velocity imparted to the surface of the shot by the spin. None of the force of the powder is expended in overcoming the resistance to the shot's progress in the barrel (therefore to its initial velocity) caused by rifling.

All these cylinders, which are so simple in their application, would be durable and not expensive, while the certainty and uniformity of their action without the risk of wrong manipulation (for they are really self-acting), promises to give them an advantage over every kind of check from friction, however ingeniously applied; and the fact of the recoil, instead of continuing a detriment, being made to aid the efficiency of the gun by the condensed air serving to run it out after it is loaded, thereby rendering but few gunners necessary, argues strongly in favour of substituting cylinders for compressors on board ship.

It is thought that the employment of them to check the recoil of heavy guns, besides adding to their efficiency in permitting large charges to be used, would, from the entire transference of the usual strain on pivots, racers, and carriages, to the immovable parapet or ship's side, effect a considerable saving in the construction of all that pertains to platforms, as well as a general saving in wear and tear from the absence of all jar and friction. It is further thought that it would effect a saving in the manufacture and alteration of ordnance, for it would diminish the amount of metal hitherto considered necessary to be given to each piece in order to assist in resisting recoil.

A convenient length being agreed upon for the recoil of the gun, what diameter should be given to the piston starting from a state of rest in air of a known density, could be computed in the following manner:—

Let—

a = area of cylinder in square inches.

p = pressure per square inch on piston at commencement of stroke.

s = length of cylinder in feet. Much determined by the pressure it can innocuously sustain.*

l = length of stroke of piston in feet. The length the gun recoils. Then,

$\frac{s}{s-l} a p$ = pressure on piston at termination of first length of stroke, and therefore the greatest pressure.

$\therefore a p \sqrt{\frac{s}{s-l}} =$ mean pressure during stroke.

$\therefore a p \sqrt{\frac{s}{s-l}} l =$ total units of work done in first length of stroke in bringing the gun to a stand-still.

* That pressure per square inch on cylinder will equal $2 p$ if $l = \frac{s}{2}$

" " " " " $3 p$ if $l = \frac{s}{3}$

" " " " " $4 p$ if $l = \frac{s}{4}$

and so on.

Again, weight of gun with its carriage, and of the shot and its initial velocity being known,

If W = weight of gun and carriage in lbs.

w = weight of shot in lbs.

V = initial velocity of recoil.

v = initial velocity of shot.

Then by the Artillery rule,

$$\frac{V}{v} = \frac{w}{W} \therefore V = \frac{w}{W} v.$$

$$\therefore \text{The total number of units of work accumulated in gun and carriage during recoil} = -\frac{W}{2g} \left(\frac{w}{W} v \right)^2 = -\frac{w^2 v^2}{2gW}$$

But this accumulated work is overcome by the work done by the cylinder in bringing the gun to rest.

$$\therefore a p \sqrt{\frac{s}{s-l}} l = \frac{w^2 v^2}{2gW}$$

$$\therefore a = \frac{w^2 v^2}{2gW} \times \frac{1}{p l} \sqrt{\frac{s-l}{s}}.$$

From this equation the area of the piston becomes known, hence its diameter.

The CHAIRMAN: If any gentleman has any remarks to offer we shall be glad to hear them. It is a very interesting subject, new to most of us, I daresay; as for myself there are one or two points that I should like to ask a question about, if Captain Scott is in a position to clear them up. First of all, when the mortar (Fig. 8) has recoiled to the position in which we see it, I do not see how it is to be loaded. Next, there seems to me to be a weak point in connection with the wear and tear of the rope round the pivots. The next is a point that I should think would be only determined by actual trial, viz., that in the case of the compression of the air, heat would be eliminated on one side, the compressed air, and cold on the other side, the rarefied air. These are points I think that can only be settled by actual trial. We know that the compression of air, very strongly and very suddenly effected, would liberate a great deal of caloric on one side. The other point that struck me at the time it was mentioned, is the escape of air round the piston. I fancy that would require trial to prove whether it would be so or not. Those appear to me to be the weak points in that system. If any gentleman, who has thought on the subject, would be kind enough to give us his opinions, we should be happy to hear them.

Captain BUCKLE, R.N.: May I ask what there is to prevent the head of the cylinder coming out by the effect of the recoil? How is that controlled?

Captain MONCRIEFF: I should like to ask whether the recoil would be in the direction of the piston, or if it would be lateral?

Captain SCOTT: As to heat and cold, or changes of temperature, I do not think that practically they would be found to exercise any material effect; I do not think they would be found to be difficulties. The wearing of the rope is a very great difficulty, there can be no doubt of it; there is always a tendency to break at a nip. However, a rope may be made of almost any strength, and with the turret guns, tackles and chains have been found to resist recoil; you have only to make them large enough and heavy enough, and then you can get them to stand; it is mainly a question of weight. A wire rope would have stood but for the nip

over the roller, which is certainly awkward. Therefore, you could only use a chain, and a chain of a particular character, viz., a pitch chain coiling over a drum, and I have no doubt that in that way you would get over the difficulty. As to loading, I take this to be rather a fancy sketch than the position in which a mortar would ever be placed. Of course it would not turn up in that way, for it would come down gradually in this line, and then you could load; but in the other case unless you had a platform across you could not load. As to the head of the cylinder going, on the piston being pulled forward, the air acts as a cushion, compressed in the way it is shown, and the air being a cushion would never allow the piston to come close against the head of the cylinder, and strike it, there would always be an amount of compressed air which would act as a cushion to prevent any damage to the head of the cylinder. I do not think there would be any practical difficulty. With regard to another question, the recoil would be in the direction of the piston, which, in this case, would correspond exactly with the water-buffer piston.

Captain MONCRIEFF: Would that be the case with the mortar?

Captain SCOTT: Yes, certainly it would, because if it were laid in the way shown, it would keep as indicated, you could not alter the line, it must really move in it. You have only to get the axis of the cylinder parallel with the line in which the piston is moving; there would be no practical difficulty in that, and then the packing would keep it steady. I confess it is a subject in which we have not many experiments to guide us, and the limits between success and failure are extremely narrow. I do not think the plan should be set aside without very careful experiment. I am sorry that General Hutchinson is not here, because he has gone thoroughly into the matter, and could explain it far better than I can. But granting that it succeeded, it would have a very great advantage over water, which is now being tried. Water, as we all know, is incompressible, and when water is set in motion by the recoil, the great check is at the first instant, and it becomes gradually less. Now, that is a wrong principle; you want the gun to recoil at first as easily as you can, and then to be brought up more and more gradually. If the air would do that, you would have a perfect compressor; therefore, if it can be successfully worked out, it be good plan.

Captain MONCRIEFF: I should not have made any remarks, only General Hutchinson has employed as an illustration a form of carriage which I have introduced, and I think I ought to say a few words about his very interesting programme. The question of absorption of recoil and of utilising the recoil of guns is a problem which has attracted the minds of several mechanical men lately; it is one which possesses very great fascination. There is no doubt whatever that the idea of using an elastic medium so perfect as air to absorb, that recoil, is a very pretty one. I may state to this meeting that four years ago I myself made designs for applying it to the carriage which bears my name. From the drawings, which of course are mere sketches, I am afraid General Hutchinson has not arrived at that stage in the process in which the real difficulties are discovered. The mere idea of applying air is a good one, but there are difficulties lying between the idea and the application of it. I noticed in the remarks which Captain Scott made that he took credit not only for the advantages of the compressed air upon one side, but for the advantages on the other side, which would have been derived from the weight of the atmosphere. Of course, if you use the one, you cannot use the other to the same extent as when the vacuum exists. I would prefer not to criticise the use of ropes passing over pulleys, and the other arrangements which I see depicted there; they evidently represent the investigation at an early stage. I think the subject is one in which there is a great deal to be done, and I hope myself to be able to describe at this Institution, some other methods of applying the same power. With regard to the mortar, it occurs to me that an elastic medium of a more solid character would be better suited for the purpose, and would make the traversing arrangements less unwieldy than those which we see there depicted.

Captain SCOTT: If you would allow me to add one more remark, I would say that General Hutchinson only intended to put forward designs, not finished models; he has merely shown the way in which his system can be applied. And after all, if it

can be applied in these ways, you have really the back-bone of the system. Although there are great difficulties to be met, as we all know well there are with every invention, because the limit between success and failure is so exceedingly narrow, still I think they may be fairly taken as well worth very full consideration. With respect to the traversing arrangement, General Hutchinson, I suppose, merely put that in, not thinking that he would be treading upon any person's toes. I think there is nothing more than that in it, for many arrangements can be made to traverse the gun without a rack and pinion, which is perhaps the simplest plan. I think, however, that the discussion of this subject should be directed rather as to whether air cannot be usefully employed, than to any particular details, and this seems to be the object that General Hutchinson has in view.

Major-General BOILEAU, F.R.S.: I should wish to say a word before the subject closes, merely to give a general opinion upon the project, because it is simply a project at present. The question of utilising recoil has for some time occupied the attention of the authorities, and that some method of this kind is desirable, it occurs to me, is proved by the fact of the water-buffer, or the application of water for the same purpose as this, which is now being experimented upon at Shoeburyness. Captain Scott has very clearly pointed out that the great objection to water is, that it checks the recoil too suddenly at first, and that the action of water then becomes gradually diminished, until at the time when it is most wanted it ceases to act altogether. I think the introduction of air in a perfectly air-tight cylinder, such as I suppose these are to be, and which is not a matter of difficulty in practice, is, as a first idea, worthy of all consideration by the authorities. If water has been applied successfully to check the recoil of guns, it is my opinion that air may be applied more successfully to the same purpose, because it better fulfils the conditions which are required than water does. Without entering into the detail of the principles, and of the proportions necessary for that air cylinder to meet the recoil of large guns, I think the design is one which exhibits great ingenuity, and which, if it can be successfully applied, will be likely to produce great and useful practical results. And should such results occur, it will only be one more added to the many instances of useful national inventions, tending to place our country in its present advanced position in regard to artillery, which have been brought forward in this Institution.

The CHAIRMAN: I am sure we all feel very much obliged to General Hutchinson, whose unavoidable absence we regret, for having given us this paper. I must concur in the remarks that General Boileau has made, indeed in all the remarks that have fallen from gentlemen; they give a good summary of the subject. It is but fair to say of this plan, that though I and others might criticise the ropes and other details, we should remember that the illustrations are simply sketches and nothing more, intended to convey an idea, which idea would be worked out practically to a good and sound conclusion as soon as we know the forces we have to deal with better than we do now. For instance, I would not take that rough sketch as a representation of what the invention is likely to come to hereafter, any more than I would take that sketch of a human figure as a representative and model of the beauty of a sailor. Still it serves to convey to our eyes the idea of a sailor. So this sketch gives us an idea of what the invention may be hereafter. The idea is the thing we have to deal with now, the practical working out is to be done by-and-bye. There are difficulties no doubt to be encountered, but I believe those difficulties will be got over by the talent of mechanicians in this country. We are very much obliged to General Hutchinson for his paper, and we are equally obliged to Captain Scott for the way in which he has read it. I have now the pleasure to introduce to you Mr. Stone, of the 77th Regiment, who will exhibit models illustrative of his new gun platform.

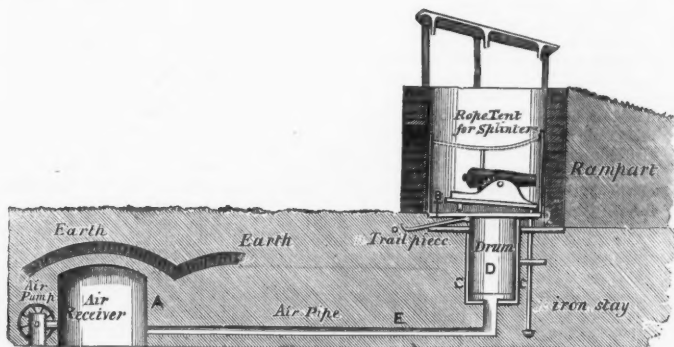
EXPLANATION AND DESCRIPTION OF AN ELEVATING GUN-PLATFORM.

By Lieutenant CECIL PERCIVAL STONE, 77th Regiment.

THIS invention is especially intended to be applied to masonry cylinders, or gun wells, placed at due intervals along the ramparts of fortifications, or in any other situation where a gun may be required to fire through an embrasure, or "*en barbette*," and to be lowered after each discharge, or not, as may be found necessary for its safety, or permitted to remain elevated should there be no pressing emergency for sending it below.

The cylinders, or gun wells, are fitted with platforms, which, with the gun, are worked upwards and downwards, and they are covered with a cap constructed of iron plating, supported on iron stanchions let into the masonry, as a protection against vertical fire; the space it covers is soon enclosed, and will permit shot driven by direct fire to pass freely through it; in fact, this cap covering is intended only to prevent shells from lobbing down the interior. The platform and gun are further protected from falling splinters by a tent-like covering of thick rope matting, which it carries up and down with itself.

A rifle-proof mantlet, or blind, working upwards from the rampart towards the capsill of the masonry cylinder, in the manner of a sluice-door, is also employed to enable the platform to be raised to firing height, and the gun laid without being seen by the enemy up to the moment of discharging its fire, and thus keeping them in ignorance whether the gun is elevated or not, and therefore in uncertainty when to fire.



The method of working the platform will be understood by reference to the diagram. A is a large receiver for condensed air, made somewhat similar to a gas-meter, and buried or placed in a masonry vault, so deep under ground as to secure it from vertical fire; the surrounding rampart, as well as its buried position, places it beyond the reach of any other shot or shell.

The receiver may be of any shape—the circular is preferred—and it may be from 10 to 12 feet in diameter, according to the capabilities of supplying it with air, or the number of guns to be manœuvred by it. The air may either be supplied by wind, water, steam, or hand power. Steam power would be the most compact, and easily managed. A small portable engine of three or four-horse power would suffice to fill a receiver to work a battery of as many as ten guns.

Branching from the receiver, in the direction of the platforms they affect, are a series of wrought-iron pipes, E, of $2\frac{1}{2}$ or 3 inches in diameter to convey the condensed air from the receiver into the lift, at the discretion of the gunner on the platform, who regulates its outlet or inlet by means of the handle, B, which, when turned in one direction, lifts the platform, and turned in the other, depresses it. He can also arrest the rise of the gun at any height between its lowest and highest points, an arrangement which offers a great advantage, as securing the gun from exposure in the event of the parapet being lowered by the crumbling effect of the enemy's shot. Each of the pipes has a separate action, and thus each gun, in its working, is independent of the others.

The cylinder, C, is a tube of wrought iron, bored out of a length proportionate to the height through which the gun platform is to be elevated; into this cylinder, C, a drum, D, is fitted, which consists of two concentric circles of plate-iron, strengthened with radiating rods and angle irons. When the handle, B, is turned to open the inlet valve, the condensed air, rushing along the pipe, acts on the drum, D, and raises the platform, with its superimposed gun and carriage; by turning the handle in the opposite direction, the outlet valve is opened, and the air escaping thereby, allows the platform and its load to descend. Air condensed to a pressure of four atmospheres will be found ample for the purposes required. A second handle may be attached to the platform, and made available, on the same principle, for traversing the gun through any horizontal angle, as the first-mentioned handle is for elevating and lowering the platform. A single gunner on the platform can train his gun from right to left, and *vice versa*, with all the precision of a micrometer screw.

The advantages claimed for this invention are:—1st, that it can be equally made available for a gun to fire *en barbette*, or through a casemate; 2nd, it is capable of adjustment to the accidental height of the parapet; 3rd, all the working gear of the platform can be made absolutely safe from the effects of every description of fire, and the gun is separable at will from the platform; and 4th, the design effects a great saving in manual labour.

The cost of the whole machinery for one gun and platform is estimated at about one-half that of one of our newly-constructed gun

shields, while if two or more guns be used, the relative cost for gearing of each will not be much over £300.

The CHAIRMAN: It is not quite fair, perhaps, that a gentleman who is not in the army should make remarks upon military questions of this sort; and if I say a few words it is only to suggest points that strike me as difficulties, which, perhaps, Mr. Stone will allude to in his reply. I do not see how the gun in the turret is to be loaded when it is down below. Loading above would, of course, be dangerous from exposure to the enemy's fire; but I do not quite see how you can load below, unless with rope sponges as at present. Again, with regard to the effect of shell, I think a shell going into that turret would have rather more effect than seems to strike Mr. Stone. It seems to me that it would not only damage the gun itself, but that it would damage the cylinder underneath it, and thereby silence the gun. There are one or two other points that occur to me, but I have not the least doubt that my military friends will take them up. I am not myself capable of criticising a military question, so I do not like to say much.

Major-General BOILEAU, F.R.S.: It is hardly possible, from a mere section of this kind, to come to a right apprehension of what the system is; and as Mr. Stone proposes, with the permission of the Council of the Institution, to give us another paper upon his system of fortification, I would not wish to make any observations upon that at present. The details are too imperfect for a complete apprehension of the system to be formed; it would be doing an injustice to the system itself—indeed, to any system which is intended to produce great results—to express an opinion upon a portion only of that which, I trust, hereafter to see brought before us in a more complete form. In regard to the question of turrets, there is no doubt that turrets are becoming now more generally employed in place of embrasures, for reasons which are patent to everybody who understands anything about defensive operations. I must confess that, at first sight, I do not like that turret. I think it has objections which are of a very grave character. In the first place, being immovable, the gun being in a fixed position, it would be quite possible for artillerists outside to obtain such a perfect aim that the gun would not show itself half a dozen times before it would be knocked to pieces. If it were like other guns of the same system, turret guns, or pit guns, or guns behind solid earthen ramparts, then the gun would pop up at one time in one place, and at another time in another. Such a gun is, so to speak, an artful dodger; and no artilleryman outside would be able to lay his piece mechanically so as to be certain to hit Jack when he popped up next time. But when the gun is fixed, as in this case, and exposes a considerable surface to fire at, I think it is very probable that the gun would be destroyed. There is another point with regard to that turret which I do not like. I think the apparatus for raising the gun is very complicated, it will be very expensive, and very liable to get out of order. We have seen in the small model the imperfection of air cylinders, and I think any such apparatus, which is of such intense importance, which is the soul of the system, which has to elevate the gun when it is required to be fired, is, in principle, incomplete. I believe that the principle of turret or pit guns is the principle that will be introduced almost to the entire exclusion of others. Still, I think we have in the pit gun and balanced carriage of Captain Moncrieff something which is inexpressibly superior to anything that has hitherto been produced. Instead of having to compress air into a chamber for the purpose of elevating a gun, all you have to do is to fire the gun; it is depressed of itself; you merely release a paul, and the gun comes up by a counterpoise weight. There can be nothing more simple in mechanical appliances than the application of the lever principle. Captain Moncrieff's gun is on the lever principle. In all other respects it is the same as this gun, with this great additional advantage that you have no outside appliances, nothing which does not act of itself. I hope by-and-by, when the subject is brought before the Institution, being myself a mechanician, to be able to say something on the points which belong to this system. In saying what I have said to-night, I speak merely upon principles, and upon those mechanical arrangements which have been produced to carry out a great object. I must say that, to my apprehension, although the principle of the turret is the one

which will command as well the respect as the favour of all engineers who are engaged in fortification, I do not think, as far as I can judge at present, that this is the mechanism which, hereafter, we shall feel inclined to introduce.

The CHAIRMAN: I am sure we must all feel very much indebted to the gentlemen who have given us this information, because although we may not agree in all the details, yet there is a great deal to be learned even by agitating these subjects. We often learn a great deal from the discussion of that which we do not agree with, because we find out from it what we shall agree with hereafter. I shall be very happy, indeed, to hear Mr. Stone on a future occasion, and to learn more from him on this subject. At any rate, we are very much indebted to him for the share he has contributed to this evening's discussion.

LECTURE.

Friday, February 26th, 1869.

W. STIRLING LACON, Esq., in the Chair.

REFORMS IN ARMY ADMINISTRATION.

By E. B. DE FONBLANQUE, Esq., Deputy Commissary-General.

It is only of very recent years that military matters of any description have afforded subject for much enquiry or discussion among the general public. If you refer to the different organs of the press during the twenty years preceding the last war with Russia, you will be surprised to find how rarely the interior economy of the Army became the subject of comment, or was even remotely alluded to, and how yet more rarely this subject was specially treated in distinct publications. Flogging in the Army, now happily abolished, furnished occasionally the material for a sensational newspaper article, and Cobbett in his *Political Register* wrote a series of papers on this subject, for which he was prosecuted and imprisoned for libel, and both in the press and in Parliament, reduction of army expenditure and of military establishments formed a favourite topic for popular writers and speakers, but the great questions involved in the art and science of war, and those not less important questions relating to the moral and physical condition of the soldier, seemed to possess no interest for the public, and even in the Army itself met with little attention beyond the sphere of those immediately concerned in the matter.

I need not tell you how, within a few years, all this has been changed, or how incalculably this change has improved the status of the soldier and with it the efficiency of the Army. It is not alone in military science that within the last dozen years we have made great strides; there is nothing relating directly or indirectly to the soldier that has not become the subject of study and practical investigation, and the result is that he is better armed, better trained, better housed, clothed, fed, and instructed than he has ever been before, and I think I may say better than is the soldier of any other Army in the world; his health is guarded by the highest appliances of sanitary science, his treatment when sick leaves nothing to be desired; he is afforded every

facility for intellectual improvement and mechanical instruction, and the State even provides him with the means of recreation and amusement for his leisure hours to an extent which but a short time ago would have been scouted as ridiculous, if not mischievous. Remembering as I do, as I am sure many of my audience do, what used to be the actual condition of a married soldier in barracks, I never see what it is now, I never notice how much has been done to make the home of the married soldier decent and respectable, without feeling struck by the radical change in public opinion which must have taken place to produce such a result. Much, it is true remains to be done before we can make the common soldier what I for one should wish to see him—the intelligent, thinking member of a noble profession—working as every man should work, with the hope of raising himself by his merit and exertions; but we have accomplished so much towards teaching the soldier to respect himself, that I do not despair of living to see military reforms gradually carried so much farther, that the Army will become not only a popular but profitable career for all classes of the community.

I should be at a loss to account for the apathy which up to a recent period prevailed with respect to military matters, and to the general indifference to the grievances of our troops. Probably the change is but the natural result of that enlarged sympathy for our fellow men of all classes, which appears to me a characteristic of the present age. I think we are now more willing to make sacrifices for the alleviation of the sufferings of others, and to take up the cause of the oppressed or injured than formerly, and that for one Howard or one Mrs. Fry that a past generation could show, there are now hundreds of amateur philanthropists battling in the cause of humanity and justice. It would be strange if the rank and file of our Army did not share in the influence of such extended sympathy, and the satisfaction with which every step in that direction has been accepted by our military authorities, is the best proof that it was only the want of support and encouragement from without, that has deferred so long the various recent improvements in the material condition of our troops.

Wholesome and beneficial as such pressure from without must always be, the military force is so peculiarly constituted that the public at large, though it gives the impulse and provides the means, cannot with advantage apply the remedy. No change can be effected in the internal economy of the Army which does not involve considerations of a technical or professional nature; and it is for administration to direct into the most useful and practical channels, the stream of public sympathy or private benevolence.

And this brings me at once to my subject—what is administration? You will pardon me if I here quote a personal experience on this subject. Some ten years ago when Lord Panmure employed me to prepare a work on the "Organization of the Army," and the departments of Supply and Finance connected with it, and I had completed my task and called my work a "Treatise on Army Administration," more than one well-informed man asked me what I meant by "Army administration?" You will smile at this, for the term has now become familiar among us, but

I assure you that in the year 1858, it puzzled a good many people both in and out of the Army. Some insisted upon connecting it with martial law, and one Officer, I remember, enquired whether it was not a new department to be formed at the Horse Guards.

The French use the term "*administration*" to express what we generally call "management." The board of directors of a commercial company for instance is called "*administration*," and the chairman of the board the "*Chef d'administration*." "*Administration militaire*," however means in France very much what it does with us—it is used to express those functions connected with the Army which are not of a purely military or combatant nature, and when I use the term it must be taken to comprise the entire province connected with the Secretary of State for War with exception of the Horse Guards, in other words all non-combatant services as distinguished from the fighting element.

Now let us look back some fourteen years, and see how the Army was administered before a War Minister was created? In those days the Commander-in-Chief was under the Sovereign, the Generalissimo of infantry and cavalry. The Master General of the Ordnance directed Artillery and Engineers, and was also the Chief of the Civil Departments connected with the supply of warlike stores and the maintenance of barracks. The Secretary at War was the administrator of moneys voted for Army services, and directly responsible to Parliament; he exercised the constitutional check upon military expenditure, and, though purely a civilian, in the event of the office of Commander-in-Chief lapsing, he succeeded to that post for the time being.* The Commissariat, which was charged with the supply of money and provisions, was directed by the Treasury; the Militia was under the control of the Home Office, and the Colonial Secretary was also Secretary of State for War, or rather the Secretary of State for War had become charged with the duties of the Colonies, which before 1800 devolved on the Home Office.

We now hear a good deal said about the present so-called double government of our Army, and the danger which might arise from a possible antagonism between a Secretary of State charged with administration and a Commander-in-Chief charged with discipline, but what is such a system compared with that which preceded it? Six independent departments, each of which had to be, or ought to have been, consulted in every detail of military arrangement? The present state of things may have its defects, but it must be admitted that it is an enormous improvement upon that which went before. I have heard persons, for whose opinions I have great respect, advocate a return to the system I have described; but it had a fair trial, and fairly broke down before the first show of war in the Crimea, and there can be no question but that the remedy adopted was, if not completely effectual, at any rate the first step in a right direction. Our administration collapsed in

* It is not generally known that under such circumstances—if I remember rightly it was after the death of the Duke of York—that Lord Palmerston became, and actually was for some time, Commander-in-Chief of the Army.—E. B. de F.

the Crimea, and this failure was so clearly traceable to the want of concentrated responsibility, that the appointment of a Minister of War to be the supreme authority over the affairs of the Army, suggested itself as the natural solution of our difficulties. The country was indignant at the sufferings to which our troops had been subjected by the want of a system of administration, and this indignation was all the greater since it could only vent itself upon shadows. "Whom shall we hang?" was the cry, but each chief department of State, Horse Guards, War Office, Ordnance, and Treasury, and each of their subordinate agents out of doors, could safely shift their responsibility, and then followed those squabbles and recriminations—that series of triangular duels which culminated in the scandal of the Chelsea Commission. The creation of a War Minister at once fixed responsibility without a loophole for escape. He was invested with great powers; he might delegate his responsibility as he pleased, make what appointments he chose, but for the result, he, and he alone, was answerable to Parliament and to the country. Such an office has long existed in other countries, but under our Constitutional Government there is a difficulty which does not prevail elsewhere. In France, for instance, the Minister of War is always a distinguished soldier, trained in military habits, and conversant with every detail of discipline and administration. He rules supreme over the Army under the authority only of the sovereign, and is at once chief commander and chief administrator. With us the case is necessarily very different. We select a War Minister not for his military experience, but on political grounds; and though the industry and application to business which, as a rule, distinguish our statesmen, and enable them during their term of office to study and master professional questions, it is, as you know, a difficult matter for a civilian to acquire a knowledge of the technicalities and economy of an army, and as a natural result he is compelled to rely upon others for the conduct of many of his most important duties. There can be no question that, as far as military considerations are concerned, the foreign system offers great advantages over our own, and if we lived under a despotic government and could resort to conscription, and spend as much money as we pleased upon the Army without let or hindrance, we might probably attain greater efficiency and a more powerful Army. But there are not many Englishmen who would purchase such advantages at such a price, and although I will not go so far as Earl Grey, who states that every beneficial reform in the Army was caused by civilians in opposition to military authorities, yet I am not sure but that the frequent infusion of new and unprofessional ideas into our Army administration may not, upon the whole, be beneficial. "New brooms," it is said, "sweep clean," and if our War Ministers have not always been men of genius or originality, they have certainly gone to their work with a good will and a firm determination to master the difficulties of their position, and to do good service to the Army. Let any one of us place himself in the position of a lawyer, or a young peer, or a country gentleman suddenly called upon to preside over a department like the War Office, and to become responsible to Parliament not only for the honour of the British arms all the world over—not only for the efficiency, the health, the

comfort, and the discipline of our soldiers—not only for the prudent and economical outlay of the public money—but for every detail of military duty from the strict and impartial administration of justice according to the letter and spirit of the law down to the latest inventions in cooking-pots or knapsacks, or the grievances of Corporal Smith and Private Jones. Let us, I say, place ourselves in such a position, and remember how in Parliament and in the Press questions are put, and criticism is freely indulged in on all such subjects, and we shall probably feel disposed to become very indulgent to the occasional shortcomings of the War Office, and perhaps wonder less at the mistakes that are sometimes made, than that things work as smoothly as they do. A French Officer once said to me: "*C'est bien drôle*; your Minister of War is a man of peace. Your administration is unintelligible; you buy your soldiers and you sell your commissions; *et cependant votre armée est magnifique*." There is some truth in this. If by Army be meant "soldiers," it is an anomaly to have a civilian at the head of the Army. Our administrative services were until lately, in a terrible muddle; our recruiting system, though now improving, is still clumsy, expensive, and not quite creditable; and promotion by purchase cannot be defended in principle, whatever may be said in favour of its practical results. Still, in spite of all, we have an admirable Army that, as far as the fighting element goes, can well bear comparison with any other, and it behoves every well-wisher of the service to do all that in him lies to place the auxiliary departments—those departments without whose aid neither the genius of generals, the devotion of officers, nor the valour of soldiers can avail—upon such a footing as will develop to the fullest extent the resources of administration, and thereby increase the comfort of the individual soldier and the efficiency of the military body. I believe that free discussion tends to facilitate such a result.

Although both recruiting and promotion are subjects which fall within the province of the Administrator, in the sense in which I use the word, I shall not venture upon this ground, but confine myself to treating of those departments of supply which, under the salutary reforms now in progress, will come under the immediate influence of the Control system.

As I said before, the Crimean war made it evident that our administrative machinery (if so comprehensive a term can be applied to the disjointed makeshifts and poor contrivances called in those days a system) was out of gear, and as little conducive to economy as to military efficiency; but, although some fourteen years have passed since then, it is only within the last year that any practical steps have been taken towards following up the reform which was inaugurated by the creation of a War Ministry. When all the great departments of the State which were concerned in Army administration were amalgamated and brought under one supreme authority—when the offices of Master General and Secretary at War were abolished, and the Colonial Office and Treasury transferred their military functions to the War Office—the subordinate agents of these departments out of doors should in like manner have been subjected to a corresponding amalgamation or

reduction. For some years after the conclusion of the War however, we made the great mistake of repairing and patching, and propping up and adding to the old worn-out, tumble-down fabric, instead of setting to work to demolish, and out of such of its materials as were still of use, with the addition of fresh bricks and mortar and new timber, to build up a sound edifice upon a new and solid foundation. The old departments had been tried and found wanting in strength and cohesion—there was no link connecting them; there was no central authority directing them; and, instead of a common and combined action to a common end, there were jealousy, and antagonism, and irresponsibility, each agency working more or less blindly in its own groove, with its own tools, and for its own object. During the first disastrous winter campaign in the Crimea, nearly the whole burden of army supply fell upon, or rather drifted into the Commissariat; but while this department found itself charged with an enormous responsibility and labour, its numbers, its organization, and its powers, remained for all practical purposes unchanged. The Commissariat had to provide money, provisions, and fuel; the Commissariat became charged with the supply of clothing and camp equipage; the Commissariat had to provide transport by land and water for every imaginable service, and to find expedients to meet every possible emergency. As well might you have expected a Thames steamboat to cross the Atlantic as that the ordinary machinery of a garrison should bear the strain of such a war. To feed an Army in a country devoid of all resources, to carry impossible loads over impassable roads, to work against physical elements, and moral elements yet more unfriendly, to be exposed to the odium of every failure, and to share in the praise and honour of no success, such was the lot of this underhanded and overworked department. After a manful struggle, it broke down under the burden, and became a safe and convenient object for public indignation to vent itself upon. Then followed a gush of extravagance. Money and men were voted without stint; a feast succeeded to the famine, and an unnatural plethora to a state of inanition. In January, 1854, the Army Transport was under the Commissariat, and one junior Officer assisted by a rabble of native overseers and drivers, had the sole direction of this important service. In the April following, a Colonel on the Staff was placed at the head of the transport, and the number of Officers under his orders exceeded that of the entire Commissariat Department. These Officers held military rank, were invested with the authority of Captains and Colonels, and had under their command a small Army of enlisted English soldiers. This was undoubtedly a great improvement on what had gone before, but it was the first step in a wrong direction, since it produced a separation of supply and transport duties; the Commissariat Officer responsible for feeding the soldier being thus rendered dependent upon the Transport Officer for the means of carrying his supplies, and the Transport Officer being made the judge of the quantity and description of transport necessary for this duty. The impracticability of working under such a system of divided responsibility soon became apparent, and was subsequently confirmed by our experience in the campaigns of New

Zealand and China. Failing as it did, however, in practice, it was reserved for Lord Strathnairn's Committee to lay down the principle that no matter what the agency be called, the Officer responsible for the duty of supply must be entrusted with the control of Transport.

On the conclusion of the war with Russia, when there was time calmly and deliberately to survey past experiences, and to remedy defects, I think we lost sight of the true source of failure, and instead of attempting to create one comprehensive administrative system under one directing authority, we set to work to strengthen and consolidate a number of independent departments. The Commissariat had not been permitted to bring with them to the Crimea the Transport which they had been at great pains to collect in Bulgaria, and subsequently they were denied sufficient means of naval transport to draw upon the *dépôt* at Varna. The Transport collected at the theatre of war did not survive the hardships of the first winter, so it was ruled that, the Commissariat Transport having broken down, a new Transport Corps, organized upon a military footing, and independent, not only of the supply departments, but of all direct War Office authority, should be created in its place. Insufficient provision had been made for the sick and wounded, therefore a new department unconnected with that which provided for the healthy troops, was created. At the present moment this department, which administers only to the sick, and does not comprise anything in the form of medical attendance, actually exceeds in the number of Officers and subordinates on home service, the members of the Commissariat, which provides for all the wants of the effective troops; the cost of the latter being only £4,000 a year more than that of the former. As the proportion of sick to healthy soldiers in the *field*, would be very much greater than in this country, think what the Purveyor's draft would become in time of war if the existing system were allowed to continue in force? The Commissariat was reconstituted upon its original basis, and what had formerly been the civil branch of the Ordnance was formed into a large department, on the model of the Commissariat. In the meantime each of these departments required a representative branch at the War Office, and so the number of clerks rose in time to, I think, 650, under no less than nine heads of departments.

Now I am not in the least disposed to join in the outcry against the *employés* in public offices. The languid over-dressed clerk who declined the offer of a cup of coffee at breakfast, on the plea that it would prevent him from sleeping a wink all day, is a creation of Punch's vivid fancy; and the popular belief that the public servants in Pall Mall and Whitehall, do nothing but read the papers and eat sandwiches, is like many other popular beliefs, utterly fallacious. So far from idleness being their fault, I am rather disposed to complain of their excessive industry; 500 educated gentlemen in the full vigour of life, are not likely to pass six hours a day under one roof with their hands folded,

"For Satan finds some mischief still
For idle hands to do."

Work becomes a necessity to them, and if not provided for them,

they will make it for themselves, and for others, and that I take it, is one of the great faults of our public offices.

A story is told of a Treasury Secretary, who was waited upon by the inventor of a copying-machine, by the use of which it was alleged, the clerical labour of the office would be immensely reduced. The official listened patiently to the patentee, admitted the value of the invention, but regretted that he could not recommend its introduction in his office, for said he, if we had a machine to copy letters, what would become of the clerks?

I am afraid it too frequently happens that we make work to employ clerks, rather than employ clerks to do work, and I am sure that the first step towards diminishing labour, is to reduce establishments.

Another fault in our public offices, and more especially in the War Office, is the waste of superior material upon inferior duties. Why do we employ highly educated men—many of whom have passed with honour through our public schools and universities, and are capable of filling high positions—in copying letters, endorsing vouchers, and totting up columns of figures—work which would be as well, if not better performed by an inferior class of men? A certain proportion of well-paid, educated, and confidential *employés* is necessary in every public department of the State, but as in the Army there are a few Officers, and a large number of Privates—so in a public office there should be rank and file under a limited number of officers. In the War Office we have only Officers, many of whom do the work of privates. The employment of soldier clerks for purely clerical duties has been tried to some extent with, I believe, great success, and I hope to see the experiment carried much further—not only in the interests of the public—not only to reduce the heavy cost of our establishments—but also to provide a suitable career for deserving soldiers, and thus to encourage a good class of men to enter the Army, not as a temporary refuge from distress, but with a view of qualifying themselves by a course of good and honourable military service, for a comfortable position in after-life. If, as I believe it certainly will, such a system as I recommend should provide a better training, and a more suitable occupation for superior *employés*, should greatly diminish expense, and further prove the means of attracting a higher class of recruits into the Army, it is surely worth trying on a greatly extended scale, of which experience has completely justified the experiment in India, where the employment of discharged soldiers in civil capacities is conducted under systematic arrangements; in Prussia, where such appointments are the legitimate and recognized rewards of good military service; and latterly in France, where the whole of the Corps of *Gendarmerie*, and of the subordinate clerkships in the War Office, and three-fourths of the clerkships in other departments of the State are conferred upon soldiers qualified for such appointments by good conduct and intelligence. I know from general experience, what admirable clerks, in the proper sense of the word, our soldiers may be made, and if there are not more good clerks in the English Army, it is because sufficient prospects are not held out to induce men to qualify themselves for such pursuits.

But it is not only that under the present system we waste good material on inferior work, but few things are more destructive to intellectual energy than for a man to be employed on work far beneath his capacity. I have great faith in the working power of an educated gentleman; but it is a sheer waste of power to employ him in such drudgery as a less educated man would perform at least as well. Sooner or later he would find his duties uncongenial and irksome; when this time arrives, he has ceased to be a good public servant, and the public has to thank itself, if he should turn out a bad bargain.

In a series of letters which lately appeared in the *Times* and the *Morning Post* upon this subject, it was stated, in a tone which bore the stamp of authority, that many of these men, disgusted with the uncongenial nature of their work, and with the entire hopelessness of better prospects, frequently apply their abilities and acquirements to other pursuits, going home to work, and to their offices, to rest.

In a large department like the War Office, it is peculiarly important that a line should be drawn between secretaries and clerks, between the higher functions of finance and administration, and the mechanical duties of a copyist. I believe that the Control system will tend to establish such a division of labour, that when we have one high Officer with competent power and authority to represent supply, and another to represent finance, instead of the many heads of departments now existing, a corresponding reduction and better classification among subordinates within the War Office will follow as a matter of course.

The true principle of administration, is division of labour, and concentration of responsibility. The actual practice of our War Office has been the reverse of this axiom, for it has gone in the direction of concentrating labour, and dividing responsibility; the principle I have quoted, is the key-stone of the new system in course of introduction.

This system has, in some quarters, been treated as if it were a dangerous revolution in our military institutions; but this is a mistake, it is not even a novel experiment.

Not only does it exist, with few unimportant differences, in almost every Continental army, it has also existed in our own service.

More than a hundred years ago, in 1751, Prince Ferdinand of Brunswick then commanding our Forces in Germany complained in a public despatch of "the failure of the Commissariat, and the faultiness of its internal construction;" the report having been referred to the Treasury, the following minute was the result:—

"My Lords, take into consideration the affairs of the Commissariat in Germany, and are of opinion that Commissaries of Control for inspecting and reporting the true state of the Extraordinaries for the service of the Army are an essential part of the institutions of the Commissariat, and that their activity ought to be enforced and attended to; for which reason, it is resolved to recommend to his Majesty the making of a sufficient number of *Commissaries of Control*, to be confined altogether to their proper branch of business, and not taken from thence to attend the providing of the Army, or the keeping of accounts, unless in case of unavoidable necessity."

General Howard was accordingly appointed Chief of the Department of Control, with pay at the exceptionally high rate of £10 a day, and here we have the first instance in our own military administration of the distinct line being drawn between the duties of supervision and execution. On the conclusion of the Seven Years' War, this machinery, however, was demolished.

During the American War of Independence, Sir Brook Watson was sent out nominally as Commissary-General, but with the powers of a Controller over finance and supply; and although no such office was formally recognized during the wars of the early part of the present century, the Commissary-General of the Duke of Wellington's armies found himself, from the necessities of his position, invested with the functions, if not with the authority of a Controller over all administrative services.

During the long peace which succeeded the fall of Napoleon, military administration in all its branches made not only no progress in this country, but retrograded; and in that dream of an eternal peace in which we had learned to indulge, it was seriously contemplated to abolish even the remnants of the weak and ill-trained departments of supply which yet survived. The Report of the Committee on Army and Ordnance Expenditure, which sat in 1850, affords a curious illustration of the short-sighted policy resulting from the false sense of security into which we had fallen. Sir Charles Trevelyan among others pointed out the danger of such measures, and remonstrated in the following terms:—

“As a necessity may at any time arise for active military preparations either at home or abroad, it is very desirable that the Government should have a small number of Commissariat Officers at its disposal in this country ready to be dispatched to any quarter where their services may be required; and it must not be forgotten that the Commissariat, although it is as necessary for the equipment of a force as the medical branch, or the artillery or engineers, furnishes the only direct means possessed by the Government for controlling the extra expenditure which swells to so large an amount on these occasions.”

The Committee decided that, as “no training in time of peace would fit a Commissary for his duties in the field during war,” the service had better be abolished. They might as well have argued, that as no training in time of peace could accustom a soldier to be steady under the fire of an enemy, the Army should be disbanded. The reduction was made. In little more than three years after, we were suddenly called to arms. I need not remind you how unprepared we were for the emergency, and how painfully the truth was impressed upon us, that it is only during the calm and leisure of peace, that effective arrangements can be completed for meeting the shock of war. Everything had to be created and organized after the time for action had arrived, and while the troops expected to be fed, housed, equipped, conveyed, and tended in sickness—we were still busy trying to establish a Commissariat, a Transport Corps, a Field Train, and a Medical Staff. The burden of supply duties fell as usual on the Commissariat; but this was now a weak, ill-organized department,

which had been hurriedly formed out of the *disjecta membra* of a dozen other services—standing alone and isolated—liked by nobody—helped by nobody—spared by nobody.

I say it in no captious spirit—but I am bound to assert my conviction, that the absence of all sympathy for the Commissariat which was very generally prevalent among military Officers at that time, who seemed to consider it rather an antagonistic than an auxiliary service, added greatly to difficulties and precipitated the failures which ensued. There were, I admit, many exceptions to this, but few Officers in authority with whom I came in contact, were capable of appreciating our difficulties, or of making fair allowance for our shortcomings. I never found it an easy matter to convince them that in helping me, they were helping the troops, and that in refusing to strengthen my hands, they were weakening their own. I might give you many cases to establish this fact, but one will suffice. In the first winter before Sebastopol, the want of fresh meat was one of the greatest causes of complaint on the part of the troops. Biscuit and salted meat were never wanting in division. But biscuit is poor food to support an over-worked soldier, and the salted meat was unpalatable from the difficulty of cooking it properly, and often useless from the want of fuel for cooking it at all. Little or no cattle could be obtained by us in the Crimea, and we had accordingly to import it from the ports on the Black Sea—no difficult task, you will say, as we had complete command of the ocean; but, unfortunately, though the Commissary-General was empowered to hire shipping, the disposal of it rested with the naval authorities, and it frequently happened that our cattle ships were diverted for other purposes, and that the supply thus failed. In December, 1854, we were particularly badly off for fresh meat; with some difficulty, however, I accumulated in Balaklava sufficient cattle to ensure for my division their roast beef on Christmas-day, and on the day before, applied for a fatigue party to bring up the cattle to the front, I having at that time no subordinate establishment of my own, except what I could form by borrowing from regiments. "My soldiers are not cattle-drivers," was the reply I received. I had accordingly to entrust the escort of the Christmas dinner to native drivers. Unfortunately, their road lay through a French camp. Now, our allies possess among their innumerable soldier-like qualities, the very important one of taking remarkably good care of themselves. In this case, their instinct carried them too far, for they appropriated our property; and though they subsequently apologised for the mistake, they did not do so until the cattle had been slaughtered and eaten; and when a day or two later Lord Raglan, who had always a kind word for every one, asked a passing soldier in our camp, whether he had had a good Christmas dinner, the man replied, "nothing but charcoal, sir."

I am quite aware how hard it must have been for a General Officer to have reduced his small overworked army by detaching soldiers for non-military duties, and how natural it is that he should be very chary of the fighting element at his disposal; but fighting and feeding are very nearly connected, and in this, as in other instances, it would have been better to have withdrawn a few men from the trenches for the sake of

assisting or supplying the wants of the many in the camp. The great fault, however, I must allow, lay in the defective organization of the supply departments. Badly and insufficiently as these were officered, they had positively no subordinates, but such as could be scraped together in the way I have described—the few civilians attached at that time being utterly unfit for their work, and for the greater part ignorant, ill-conducted, and insubordinate. The formation of departmental corps for the commissariat, the military stores, and the hospital departments has now supplied this deficiency, and we should find in them an invaluable assistance on active service.

Now, in the French Army, although the *Intendance* had, during the Crimean war, a complete and thoroughly organised *corps d'administration* under their orders, the further demands made for military labour were invariably complied with.

When the *Intendant-Général* wished to establish a dépôt of supplies at Baidar he made requisition for, and obtained, an entire battalion, who, from the Colonel to the drummer-boy, were placed at his disposal for administrative services, and no one thought this a hardship; for no one in the French Army considers it a joke to see the *Intendance* in trouble, knowing that it is the Army itself that must suffer from such failure.

It is useless now to reflect upon the saving in human suffering, in money, and in prestige which might have been effected, had something like a Control system existed during the Crimean war. Even during its progress, the formation of a central directing power on the spot was urged from various quarters, and subsequently Sir Charles Trevelyan, who during his long and intimate connection with the Commissariat, had thoroughly mastered the principles and the practice of military administration, and the late Mr. Godley, Assistant Under Secretary at the War Office, and one of the ablest and most enlightened and far-seeing officials I have ever had the good fortune to meet, strongly represented the absolute necessity of some such institution. In a memorandum written in 1855, Mr. Godley says—

“It is worthy of consideration whether it may not be found necessary to attach to the armies in the field and to garrisons, Officers corresponding with the Intendants of the French Army, who may, in strict subordination, of course, to the Commander of the Forces, superintend and control the several civil services connected with the Army. In the last war, this function was practically in great part discharged by the Commissary-General, whose department had the charge of all the duties which are now divided, and are likely to be divided, among the Storekeeper, the Director of Land Transport, the Commissary-General, and the Treasury Accountant. It is more than questionable whether the common subordination of these Officers to the Commander of the Forces be sufficient to ensure that unity of action and mutual co-operation among them which are essential to the success and safety of the Army.”

In the same year, a Committee of English Officers, under the presidency of Major-General Knollys, drew up an exhaustive report on the French *Intendance*, from the concluding paragraph of which I would beg to be allowed to make a short quotation:—

"Next, we would point out the admirable organization of what may be termed the Civil Service of the French armies, by which a General in command has always at his side a chief of the Civil Staff, having at his disposal all the means of provision and of transport, and ready to place before the General a review of the extent to which those means will reach, so that before undertaking any military movement, the General may know exactly how far his troops can be supplied with everything necessary to enable them to command success.

"And next in connection with this subject, we would point out that wise division of duties and responsibilities among the various departments of the Civil Administration, by which the heads who have to foresee and provide for the consequences of every military operation, are relieved from the cares and anxieties attending the supervision of details; so that an Intendant when studying the resources of various countries, and calculating the best means of drawing from each the supplies which it is best calculated to afford, is not liable to be interrupted by the necessity of issuing rations, or making payments, or casting up accounts."

In 1858, I ventured to publish my opinion, that none of our administrative reforms would avail until we should introduce that "most essential element, a superintending department, to control and direct all services not of a strictly military nature;" and in 1864, Sir William Power, in his evidence before a War Office Committee, under Lord Hartington, sketched the outline of a department of control which hardly differs in any material respect from that now actually in course of formation. These suggestions were adopted by Earl de Grey, who in 1865, proposed to the Treasury that, "both on account of economy in peace and efficiency in war, the several administrative departments should be brought to a focus," both locally and in the War Office. Lord Hartington, in moving the Army Estimates in 1866, stated that it was the intention of the War Office to appoint a superior class of Officers, to be called Controllers, who should be placed in charge of the administrative departments at each military station;" and he appointed a Committee, under the presidency of Lord Strathnairn (then Sir Hugh Rose), to report upon the subject. I should here perhaps mention, that the original instructions to this Committee were limited to the questions of the organization of Army Transport; but this subject was so inseparably blended with supply generally, and the impracticability of separating the two services and dividing the responsibility attaching to them, was so evident, that General Peel, who had in the meantime succeeded to Office, sanctioned the larger question of a Control system being included in the deliberations of the Commission, who sent in a preliminary report in September, 1866, and in the spring of 1867, presented that full and interesting Report, now so well known, under the name of Lord Strathnairn's Committee, and which forms the foundation of the new Control scheme. In January, 1868, Sir John Pakington gave practical effect to these recommendations by the appointment of a Controller-in-Chief at the War Office, and it remains for the present Secretary of State to crown the work of his predecessors by the formal inauguration of the new system throughout the

Army. The fact that the principles laid down by a committee composed of the distinguished representatives of all branches of the Service should have been adopted by no less than five successive War Ministers, each of whom more or less helped their progress, affords a fair guarantee for the thorough soundness of the proposed reform; from which I, for one, anticipate greater moral and material results than have yet arisen from any change we have made in our system of Army administration since our Army was created, or an administration formed to supply and regulate its wants.

I am inclined to believe that the peculiar organization of our military staff has hitherto had an injurious effect upon the supply services of the Army. In France, as in most other countries of the Continent, the *Etat-Major* represents the purely military, and the *Intendance* the purely administrative services. The former is a distinct corps, for admission to which Officers of all arms qualify by a course of study similar to that pursued at our Staff College. Thus a Colonel, or Major, or Captain of the Staff Corps is posted to a division or brigade, and becomes available for any duty which his General may impose upon him. No man is appointed a Quartermaster-General, or an Adjutant-General, or Military Secretary, or Brigade-Major; he is simply detailed for staff duties, and the senior Staff Officer so detailed becomes *Chef d'Etat-Major*, and distributes the various duties among his subordinates. It may be a reconnaissance or a survey to-day, a matter of discipline to-morrow, and carrying orders the day after. I am inclined to think—though it is a subject upon which I speak with some diffidence—that this system has advantages over our own, and that nothing is gained by dividing the military staff into separate departments, under distinct heads.

In the field the duties of our Staff Officers are perfectly defined, and the Quartermaster-General and Military Secretary have each full employment within the legitimate provinces of their functions; the former in strategical arrangements, in military surveys, reconnaissances, and the movements and camping of troops; the latter as chief of the personal staff and private secretary to his General: but in garrison the case is different, and having nothing else to do, they have come by degrees to assume a kind of supervision or interference in supply and finance duties, which has only the effect of weakening responsibility and increasing correspondence.

Now I don't believe in any system of military administration which is only applicable to times of peace, and is thrown overboard when war breaks out. As soon as an army takes the field, both Quartermaster-General and Military Secretary find that they have quite enough to do without meddling in the affairs of other departments. There are doubtless many now present who took part in the first landing in the Crimea. No sooner did we land than the whole efforts of the Commissariat were directed to hiring or seizing transport; and as the Crimean Tartars showed every disposition to place their services at our disposal, being assured that they would be well paid for, we had within 24 hours a very respectable establishment of ox-arabas and horses collected at Calamita Bay. On the following morning we were

ordered to transfer all transport to the Quartermaster-General's Department, and thenceforward we could not obtain a single cart for conveyance or collection of supplies, except by requisition upon the Quartermaster-General, who had not the means of judging of the extent and nature of our wants, and who naturally enough attached greater importance to the more military requirements of the Army than to the carrying of provisions. Now if this department had held itself responsible for the supply of the troops, nothing could have been said against such an arrangement, but every Staff Officer would have utterly repudiated such a responsibility. If all went right his was the credit; if anything went wrong, he was free from blame, and so the Commissariat had to play the losing game, vulgarly called, "Heads you lose; tails I win."

I believe the Quartermaster-General himself was the first to admit that this arrangement placed him in a false position, and a few days later, Lord Raglan ordered that all transport should be placed under the Commissary-General. In like manner the Military Secretary found out that finance was not his vocation, and a Commissariat Officer was specially attached to head-quarters to relieve him of a duty entirely foreign to his position, and for the proper performance of which he could not find either the necessary training or experience.

The introduction of the Control system will remove such anomalies, and by relieving them of extraneous duties, will render Staff Officers generally available for the performance of their legitimate functions in whatever branch they may be required. At present the Commander-in-Chief, and under him Generals commanding divisions and brigades, convey their orders and correspond through these different channels—through the Adjutant-General on discipline, the Quartermaster-General on supply movements, and the Military Secretary on promotion and finance. As supply services are now in course of amalgamation under a Controller, so a corresponding amalgamation of the Staff under one head, would appear to suggest itself as a logical result. Thus a General would have two principal agents and advisers; on his right, the Chief of the Staff for military; on his left, the Controller for administrative services. I do not think it is easy to over-estimate the reduction of correspondence, the simplification of work, and the increased concentration of responsibility which must result from such a change, or the extent to which it would relieve a Commander from a number of harrassing details at a time when his mind should be left most free for maturing his plans and directing his military operations.

I have hitherto spoken of the Control system very generally. I will now place before you, in as concise a form as possible, its details. As I have said, the administrative service of the Army has hitherto been distributed among five distinct departments: the Commissariat for money and provisions; the Military Store Department for munitions of war; the Purveyor's Department for hospital supplies; the Barrack Department for the maintenance and appropriation of military buildings and furniture; and the Military Train for transport. Each of these departments has its chief at the War Office, and its local head at each military station, where there is a Principal Commissariat Officer, a

Principal Store Officer; a Principal Barrackmaster; a Principal Purveyor; and a Principal Transport Officer; each corresponding with the General in local command, through the Quartermaster-General, Adjutant-General, and Military Secretary, and with the War Office, through the central head of the department. Each of these heads worked under distinct regulations, and each was more or less jealous of the attitude assumed by its neighbour, and tenacious of its own dignity and independence; and thus they conscientiously and industriously played the game of cross purposes at the public expense. For the result, it is not they who were to blame.

Now a certain amount of mere formality is necessary in the transaction of public business, and those who point to a large banking establishment or counting-house as an example to Government offices, forget the widely different conditions under which these work. Red-tapeism may be and often is carried to a preposterous length, but a certain amount of red-tape is indispensable for keeping public departments in working order. Nothing has been more unjustly blamed than the thing called routine; for though it may be overstrained, it has been well said, that "routine is to administration, what law is to justice."

Routine, however, should be the servant, not the master, and the revolution which has of late times taken place in the whole system of warfare calls for a thorough revision of the system of administration, and of simplification in the routine which subserves it. Perhaps, the one element which will most distinguish future from past wars, is "rapidity;" rapid concentration, rapid advance, intense energy, decisive action. With the introduction of steam and electricity, the old machinery becomes not only useless, but cumbersome and mischievous. A writer in the *Edinburgh Review* remarks, that the introduction of gunpowder did not cause a greater revolution in warfare than has been created by recent improvements and scientific inventions, and administration in all its branches must keep pace with the giant strides of military science.

In days gone by, it was possible to create, as the Duke of Wellington did create, the essentials of an army, after the troops had actually taken the field and faced the enemy; for the future, hours will be of more importance than months were then. A campaign will be the affair of weeks instead of years; and although the preponderance of numbers must always incline the scale, I venture to believe, that that Army will be the most successful which shall be the first to take the field in the most complete state as regards its equipment, organization, and the entire machinery for expediting its movements, and supplying its wants.

Under the administrative system, which is now in course of reformation, it was not the routine that was in fault but the impossibility of making routine subservient to practical duty, owing to the multiplicity of channels through which it was required to pass. I will give you a case in point which fell under my own observation:—The Commissariat required a weighing-machine, which the Military Store Department held in charge, and addressed a requisition to the Quartermaster-General, who submitted it to the General Officer in command, who

having approved it, returned it to the Quartermaster-General, who sent it back to the Commissariat, who forwarded it to the Military Store Officer, who submitted it to the War Office; whence, after travelling among the different heads of departments for ten days, it was returned to the Commissariat Officer, who sent it again to the Military Store Officer, who made a requisition on the Quartermaster-General for a cart to convey it, which requisition the Quartermaster-General sent to the Transport Officer, who provided a four-horse waggon with two drivers and a non-commissioned officer, to carry the machine from the Military Stores to the Commissariat Stores, a distance of 30 yards. I can assure you that this is no exaggerated illustration. Now let us see how this transaction would be conducted to-day. The Commissariat Officer would apply to the Controller, who would refer to his returns, and finding that the article demanded was in store, give the order to the Store Officer to deliver it, at the same time ordering the Transport Officer to have it conveyed by the first empty waggon passing on its way to the Commissariat.

The Controller will in fact represent these five principal heads rolled into one, with direct responsibility to the Controller-in-Chief at the War Office, and to the Officer in local command, whose orders he will receive and promulgate among the Executive Officers under his direction. These officers are—

- 1st. Three classes of Commissaries for the supply of provisions, of military stores, and of hospital requirements.
- 2nd. The Transport Corps for all Army purposes.
- 3rd. Staff Paymasters and Treasurers for raising funds and disbursing, and accounting for military expenditure.

Under the first head are included the existing Commissariat, Military Store, and Purveyor's Departments, minus the two higher ranks in each, which will gradually be abolished; and although each of the three classes of Commissaries will be kept as much as possible to their own peculiar work—the first to the supply of food, the second to the custody of non-consumable stores, and the third to the supply of the sick, they will form one department and be virtually exchangeable and transferable when the necessity may arise for supplementing the deficiencies in one branch from the superfluities in another. At present if there should be ten Officers in the Commissariat over and above what are wanted, and the same number deficient in the Military Store Department, new appointments would have to be made in the latter while the former would remain overhanded. In future all will be available for general supply duties.

Under the Commissariat there will be a departmental corps, comprising the existing Commissariat Staff Corps, Military Store Staff Corps, and Army Hospital Corps, who will in like manner be sectionally divided for their respective duties, but like the Officers be liable to be transferred to one of the other branches should the convenience of the Service require it.

The amalgamation of the three existing corps is now in progress, and one Officer will take the place of the three now charged with the discipline and general direction of the men.

When I stated that the new Commissariat would comprise the Military Store Department, I should have mentioned that the question of bringing the administration of warlike stores under the Controller is still under consideration. At present the Military Store Department is charged with the custody of ordinary stores, such as furniture, implements, camp equipage, &c., and of those stores which the French call *Munitions de Guerre*, comprising arms and ammunition of all kinds. Over the latter the Officers of the Royal Artillery exercise a kind of supervision in their capacity of "Inspectors of Warlike Stores."

Now it would be quite in the natural course of things for a branch of the Commissariat to hold and issue ordinary stores and camp equipage, but I am inclined to think that special knowledge and training are necessary to deal efficiently with guns, shot, and shell, and that, more particularly for the supply of ammunition in the field, a distinct agency is requisite. I should, therefore, be disposed to advocate the formation of a department, to be called Commissariat of Ordnance, to be trained exclusively for this duty, in connection with the Military Manufacturing Departments, and to be organized with a view to maintaining a regular and continuous supply of ammunition on active service, a duty which with the improved weapons now in use, and the consequent largely increased consumption of powder and shot, becomes of such paramount importance. Whether such department should fall under the direction of the Controller or of the Artillery is, I think, a mere matter of official convenience. The Director of Ordnance is as much an administrative Officer of the War Department as the Controller-in-Chief—as much interested in the judicious management of public property, and as responsible to the Secretary of State for economy. The duty partakes, more especially on service, of a military rather than a non-combatant character, and upon the whole I think that this service might with advantage be withdrawn from the jurisdiction of the Control Department. Be this as it may, there can be no doubt that a division of such stores under two departments would be very beneficial, and that the one charged with the supply of warlike stores should be specially trained and organized for this duty.

The Commissaries of Stores then, whom I have included under the new Commissariat, would hold and issue all ordinary stores, and would further be the custodians of the furniture and stores now in possession of Barrackmasters, whose office will be entirely abolished, their administrative duties in connection with general expenditure devolving on the Control Department, in direct communication with the General, and with respect to the assessment of damages and custody and repairs of buildings, on the Royal Engineers.

The Transport Corps will be substituted for the existing Military Train. When I had the honour of addressing you two years ago on the subject of "Commissariat Operations in the Field,"* I referred to the defective organization of the Military Train for the purpose for which it was intended. The fault lay in its being organized on a military

* Vide Journal of the Institution, Vol. X., Page 463.—Ed.

footing, commanded by military Officers, and drilled on military principles. It is but natural that it had military tendencies, and came to prefer fighting to carrying, and drill to driving—in short, to be a little above its work. The new corps will be differently composed; it will, in fact, consist of enlisted waggoners, sufficiently drilled for the proper performance of their work in connection with troops, but freed as much as possible from military trappings and equipment—a kind of military “Pickford” Corps. It will be directed by Officers to be called Commissaries, who will make the organization of transport the business of their lives, and it will be under the immediate authority of the Controller. I will not enlarge on the question of Transport, but I am glad to hear that so important a feature in Army administration will before long become the subject of a lecture here by an Officer peculiarly qualified to discuss it.

The third of the sub-departments is that charged with finance, pay, and account duties, representing the Commissariat Officers now employed on foreign stations as Treasurers and Military Accountants. Great benefit might, in my opinion, be derived from an arrangement under which these Staff Paymasters should be made interchangeable with regimental Paymasters, as a link between general and regimental finance would thus be established, and such a system would bring this branch of the service into more complete harmony with the Army generally, and produce a large economy. Lord Strathnairn’s Committee have strongly urged the adoption of such a plan.

I should be disposed to create a similar connection between general and regimental supply duties, by substituting for the existing Quartermaster a kind of regimental Commissary, transferable to the staff when necessary or convenient, and available for duty in any one of the three branches of the Commissariat of Supply.

The Controller has thus the three departments of Supply, Transport, and Finance under his direction; that is to say, he instructs the executive Officers as to the wants of the Service, supervises them in the performance of their duties, and is responsible that they conduct their respective transactions in strict conformity with the regulations established for their guidance; but the Controller’s responsibility is moral, not material; he can, under no circumstances be the custodian of or the accountant for either money or stores, nor could he be held responsible for losses arising from neglect on the part of the executive Officers under him, unless he should have failed in that supervision or inspection, for the due exercise of which he is vested with a position of power and authority approaching that of local representation of the Secretary of State.

Here I should however refer to two opposite lines of hostile criticism against the Control scheme, which have appeared in the public prints and been hinted at in Parliament. One argument is, and this comes from military quarters, that the Controller will be apt to assume a position of independence towards the Officer in command, incompatible with military discipline; the other, that in being placed under the orders of a General in local command, the constitutional control over public money and stores will be diverted from its proper

channel and exercised by a military Officer instead of by the Secretary of State. Both arguments are utterly untenable. The General Officer on a foreign station is the actual representative of the Secretary of State to whom he is personally responsible for any administrative measures he may initiate, and it is to support him in this responsibility that a Controller is placed under his orders to advise him upon this branch of his duties. A Controller could no more over-ride a General in matters of administration, than an Adjutant-General could over-ride his authority in a matter of discipline. Both of these Officers would be bound in duty, respectfully to warn their chief were he to give an order contrary to regulation; but, should he persist in such order, both would be equally bound to obey it, the responsibility for the consequences resting with the General. The Controller is, however, himself responsible for any unauthorized transaction which the General may sanction upon his recommendation.

To make a Controller independent of the General Officer in command of the troops to whom he is attached, would strike at the root of discipline, neutralize all responsibility, and create a divided authority which would only result in confusion and failure. To make him, on the other hand, only the irresponsible subordinate of the General would destroy his usefulness and the object for which his office is created. It is curious that civilians and soldiers should each apprehend in the Control system encroachment upon their positions, and that while the former have dressed up a bogey called the Horse Guards Plot, to frighten the War Office, military men seem induced to oppose the scheme, lest it should bring too large a preponderance of the War Office element to bear on military affairs, and induce War Office clerks to usurp the command of the Army. I believe that a better acquaintance with the principle of the Control system will remove the objections on both sides, and induce even the *Pall Mall Gazette* to see, if not to admit, the error of its ways.

The element out of which the Control department should be formed, involves questions of considerable importance. Lord Strathnairn's Committee recommend the appointment of picked men of the existing departments, with an infusion of military Officers of all arms; but the necessity for absorbing as far as possible the existing materials, renders the immediate employment of military men a matter of some difficulty on grounds of economy. That such an infusion would be very advantageous, I cannot for a moment doubt; for not only would it tend to introduce harmony between the combatant and non-combatant branches, but the professional knowledge which could be brought to bear upon administration by the employment of men conversant with the details of the different arms of the Service would prove most valuable. The French *Intendance* is now recruited exclusively from Officers of the Staff Corps, not under the rank of Captain, who resign their military position on joining the department; and although I do not think that to exclude civilians would be a wise measure in our Service, I believe that ultimately, and after absorption of the members of existing supply departments, it would be of advantage to give the Control department a more military character than from its present composition it can possess.

The sub-departments will, in like manner, be in the first instance formed from existing departments; should that connecting link to which I have referred be established between the Staff and Regiments, Paymasters and Commissaries would ultimately be drawn from the line, and I believe that were such a prospect held out to deserving and well-qualified non-commissioned Officers, it would tend to attract a very superior class of recruits to our Army, and at the same time furnish an excellent source of supply for the executive supply duties.

I have endeavoured to present to you an outline of the system now in course of introduction, with a view to improving the administration of our Army, a system of which for many years past I have been a persistent, though humble advocate; the progress of which I have watched with deep interest; and of the final success of which at no remote period I feel very confident. Every reform has its enemies, as every abuse has its defenders, and it is not easy to over-estimate the difficulties which had to be met by those to whom it fell to establish the principles, and who became charged with the duty of carrying out the details of such a reform as this. The interests of one class must be protected, the prejudices of another conciliated, the opposition of a third disarmed. Men who have long worked, zealously and faithfully, in one groove, are difficult to convince that their groove is the wrong one; they cannot bring themselves to believe that a system in which they have been trained from youth, under which they had laboured all their lives, can be a faulty one, and they believe conscientiously, that to upset it would be perilous, if not ruinous, to the public interests, which they have at heart. Like Jack Falstaff, they are of opinion that anything else might be abolished, but that to touch them would be fatal.

"No, my good Lord," they say in effect, "banish Peto, banish Bardolph, banish Poins; but for sweet Jack Falstaff, kind Jack Falstaff, true Jack Falstaff, valiant Jack Falstaff, and therefore more valiant, being as he is, old Jack Falstaff, banish not him thy Harry's Company—banish plump Jack, and banish all the world!"

The steady and conscientious opposition of such men presents a formidable barrier; then there are others whose hostility is less disinterested. Every great change involves some sacrifices, and few men are so patriotic as to be willing to secure the interests of the public at the expense of their own comfort, dignity, and position. The French have a proverb, which lays it down that you cannot possibly make omelettes without breaking eggs; but if eggs were sentient, they would doubtless be selfishness enough to demonstrate the utter uselessness, if not the danger of omelettes.

Then, again, there is a class of people, who from mere timidity, exaggerate all difficulties, and see dangers in every change; and there is that yet larger class, large in every walk of life, but largest perhaps in official life, which from moral indolence or mental short-sightedness, is for what is called, "letting well alone," and which, provided that a thing seems likely to last their time, they prefer not to tamper with. I have found that these people are generally successful in the public service; they are what are called "safe men."

When it is considered how strong these antagonistic elements within the walls of the War Office must be—and in making this remark I wish to guard myself against the intention of speaking disparagingly of those who honestly and conscientiously oppose all such changes—when we reflect what an enormous resistant power is presented, even by the passive opposition, the *vis inertia* of office, we may congratulate ourselves upon the progress which has been already made in the direction of so beneficial a change, and we cannot fail to appreciate the ability, the tact, and the energy of those to whom this difficult task has been confided, and who have in the course of one year, brought their labours to so successful an issue.

Evening Meeting.

Monday, March 15th, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES of MEMBERS who joined the Institution between the 15th February and the 15th March, 1869.

LIFE.

Watts, J. S., Navigating Lieut. R.N. 9l. Wilson, A. K., Lieutenant R.N. 9l.

ANNUAL.

Montgomery, W. Edward, Lieut. Sco.	Mist, Henry W., Capt. Roy. Engrs. 1l.
Fus. Gds. 1l.	Lawrence-Archer, J. H., Captain late
Teschemaker, T. R., Major (ret. f. p.)	4th W. I. Regt.
Roy. Art. 1l.	Sexton, M. S., Capt. Roy. Art. 1l.
Fitz-Gerald, J. Penrose, Lieut. N. Cork	Grant, W. B., Captain R.N. 1l.
Rifles. 1l.	Russell, Charles R. T. Lieut. R.N. 1l.
Jenner, Stephen W., Lieut. Roy. Engrs.	Gimson, Herbert, Navigating Lieut.
1l.	R.N. 1l.

WORKING HEAVY GUNS ON THE BROADSIDE, WITH SOME OBSERVATIONS ON THE ALL-ROUND FIRE, COMBINED WITH THE BROADSIDE SYSTEM OF ARMAMENT.

By CAPTAIN EDMUND WILSON, R.N.

It is with much pleasure that I read a paper this evening, by permission of the Council of this Institution, on my plan for "working heavy guns on the broadside, present and future, with some observations on the all-round fire, combined with the broadside system of armament."

I will endeavour to make my views on these subjects as clear as possible, so that those unacquainted with the working of heavy guns in all kinds of weather, may comprehend the simple, yet I hope efficient, plan for working them on the broadside under almost any circumstances, and which I have now the honour to bring before you.

If we look back, even to a quarter of a century, what wonderful

ARMOUR-PLATED TWIN-SCREW CORVETTE, 14 GUNS WITH THE ALL-ROUND FIRE.

Fig. 1.

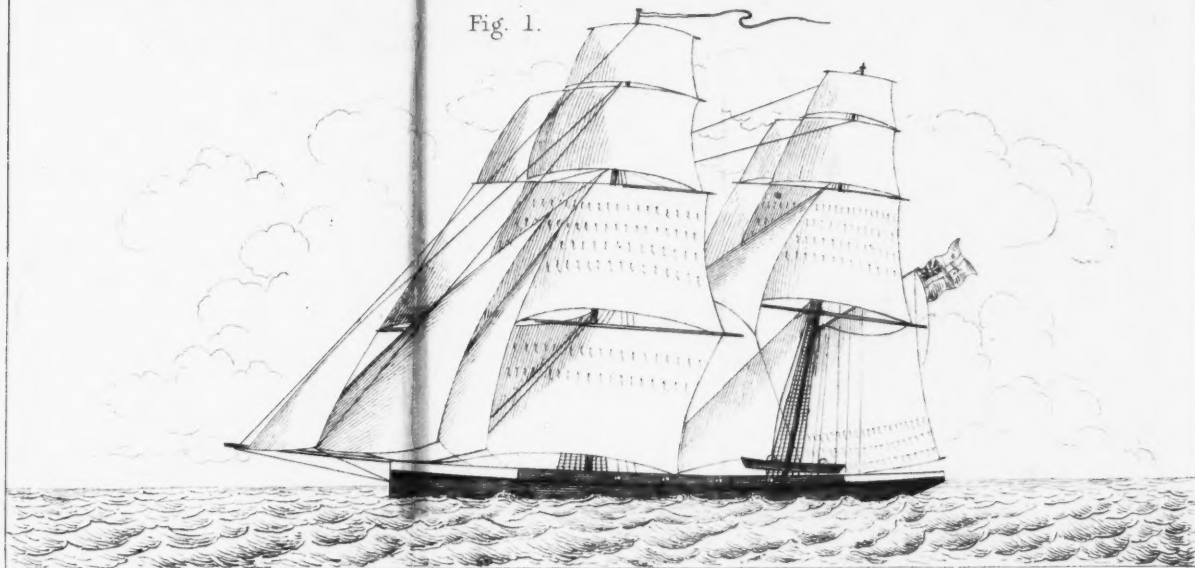


Fig. 2.



*Bow-Gun of the Hercules when pitching
down to her house holes.*

Fig. 3.



*Bow-Gun of the all-round fire with the
same angle of pitching.*

Fig. 4.

Bow-Gun of the Hercules when pitching down to her hause holes.

Bow-Gun of the all-round fire with the same angle of pitching.

Fig. 4.

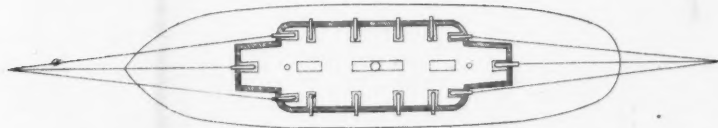


Diagram showing the all-round fire combined with the broadside system of armament 3 guns ahead or astern converging at 20 yards

Fig. 5.

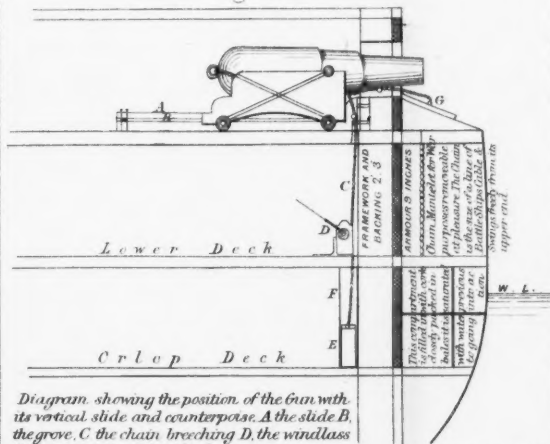


Diagram showing the position of the Gun with its vertical slide and counterpoise A the slide B the grove, C the chain, broaching D the windlass E the counterpoise F the grinder G. The port with chain attached to carriage for raising the port as the Gun fires.

Scale 1/4 in. to a Foot

Fig. 6.



Hercules when rolling 20° height of Gun from water line, almost touching.

Fig. 7.



Proposed Ship with internal armour when rolling 20° height of Gun from water line, 8 feet

changes have taken place, not only in the armament of our Fleet, but in its construction! At that period little did we dream of having an iron-clad Fleet, with 12-ton guns on their broadside, yet at this present moment we have actually a ship carrying 18-ton guns, besides hundreds of tons of armour.

Who can say then what the gun of the future may be, and whether we shall meet with equal success in working it on the broadside as is *supposed* to be the case with the present 12-ton gun? I say supposed, because it has been asserted that, although the present plan of working them has many good points, they are not under perfect control in a heavy sea-way, and they have not a *bonâ fide* pivot.

It is reported that the Bellerophon was utterly unable to fire her guns when she was rolling only 13°, and this partly on account of her large open ports admitting so much water, and partly on account of the impossibility of running the guns out with the endless chain, which, having a certain amount of slack, threatened, at every lurch the ship gave, to allow the gun "to take charge."

Now, as far as my judgment goes, we already labour under a disadvantage in carrying the 12-ton gun in its present position; and if my audience will cast a look at this model they will perceive that the guns and armour partake, in some degree, of the advantages of the turret, inasmuch as the weight becomes more centralized, and its guns would fire clear of the seas when the guns of the common broadside ship would be buried; I, therefore, consider that this is the best position for the gun of the future to be carried with ease, and to be worked to advantage as a broadside gun, the calibre of which it is impossible for us at present to conjecture. The present turret, however, can work the heaviest gun, so that if my plan for working the gun of the future be adopted, those who advocate the broadside system may still cherish the hope that, as an ocean cruiser, the turret type will be inferior in every respect to the broadside type of ship I propose, and models of which are now before you.

It may not be improper here to observe, that no turret has yet received the concentrated fire from four 18-ton guns represented by the broadside of the "Hercules," the effects of which, if well aimed, would, I should say, render it completely *hors de combat*.

Now, as the turret, as a sea-going ship, cannot command an all-round fire, it becomes a matter for serious consideration what is the best plan for carrying the gun of the future, so as to make it available to command a perfect all-round fire, combined with the powerful force of a concentrated broadside from four 18-ton guns represented in that position in Her Majesty's ship "Hercules."

Now, the "Hercules" may be said to possess an all-round fire, but it is far from being perfect. For instance, the moving of broadside guns to fire through recessed ports is, at best, a poor substitute for an all-round fire, and the danger in moving these monster guns in a rolling sea must not be overlooked, but for fighting in smooth water I consider the armament of the "Hercules" embraces an all-round fire, as, in addition to the movable guns for her recessed ports, she carries two 12-ton guns at either extremity, firing on a line with the keel clear

of any obstruction, which guns, however, would be quite harmless in rough weather, or even in a moderate sea when steaming head to it.

Now it will be as well to consider, in working the gun of the future on the broadside, whether we cannot introduce an armament for a ship, say 300 feet in length by 64 in breadth, which shall embrace a powerful broadside battery, and combining a perfect all-round fire.

With all due deference to our talented chief constructor, Mr. Reed, I think that if he had built the "Hercules" something after this model (which I by no means say is perfect) the result would have been far more satisfactory, and a considerable expense saved, by adopting the composite system of ship-building combined with my plan for internal armour.

I must premise, however, that the model before you was designed in 1863, with an armament of 24 6-ton guns, since which we have come to 12, and now to 18-ton guns, consequently her former armament is reduced to 12 guns of heavier calibre.

Now an 18-ton gun requires at least 25 feet between each port, and 9 feet head room. On going on board the "Hercules" her battery appeared to me to be very much cramped; her ports, in fact, were only 14 feet 6 inches apart, and the breech of the gun in close proximity to the deck beams. The plan for working these guns appeared to me to be very complicated, and they certainly could not be worked with breechings and tackles, in case of accident to the machinery, like the models before you; while the recessed ports would act as a sort of shoot for conveying shell and other missiles into the battery. The system of pivoting is weak, and exceedingly liable to fracture from the enemy's shot.

I put it to any unprejudiced person here, whether the battery in this model could not mount four 18-ton guns on each side, and three crossing each other from bow and stern, with 25 feet between each gun, and 9 feet head-room, and also possessing the great advantage of the internal armour principle, by placing a 25-ton gun (which, mind you, the turret is now armed with) 6 feet further in-board, and well clear of the seas, which, at the same inclination, would surge the guns of the "Hercules." (Plate VI., Figs. 2 and 3.)

These are points, gentlemen, for your consideration, and it remains with you to express an opinion whether the gun of the future can be carried and worked with ease on the plan I propose, or to decide that it can only be carried in the turret.

My friend, Admiral Key, under whom I have served, and whom, we all know, it is a pleasure to serve under, and to whom I am much indebted for the care and attention he has taken in inspecting my models, is under an impression that my plan for working heavy guns on the broadside is not adapted to the present system of pivoting in the centre of the port, as it precludes the use of the hollow pivot, through which the chain breeching passes, as shown in my model No. 2, and necessitates the port being made larger on the outside.

Now, the only advantage I can see in the centre pivot is, that it gives the gun a small additional amount of lateral training, and having a comparatively narrow port outside, but showing a very broad one inside.

Now, the narrowness of the port outside is very deceptive, so far as concerns the gun and its crew, in affording them protection—for a shot would be sure to penetrate the side which is so much cut away in the beveling, causing innumerable splinters of iron, killing or wounding the whole of the gun's crew, and probably upsetting its complicated machinery.

The pivot, as I previously mentioned, has its weak points also. If a shot should strike the side just below the cill of the port, the only protection the pivot has, is the armour and part of the backing; this, the gun of the present day would be certain to knock away with a single shot, whereas with my pivot the shot must pass through the whole of the ship's side, and then receive a very hard blow itself before it could be damaged.

Now, although my port shows a larger opening on the outside, the inner side is considerably smaller than the port I have just mentioned, consequently I do not cut away near so much of the ship's frame, as the bevel is reversed. My plan, too, for closing the port as the gun fires, completely protects the crew from rifle balls or grape shot, which, to my mind, is of paramount importance when engaging an enemy, who is sure to be provided with the best rifle marksmen. It is a well-known fact that in many instances during the late American war the gunners could not load their guns at a moderate range without being picked off by rifle bullets. My port is of wood sheathed with iron of sufficient thickness to resist either grape or rifle balls.

Now, should a shot come in through my port (which shot would have struck the thin bevel edge of the narrow port, causing innumerable splinters of iron, etc.), it would probably pass through the port on the opposite side of the ship, killing, perhaps, one or two men, but free from the disastrous effects of iron splinters. As regards the pivot in model No. 2, I think there can be but one opinion, which is most to be depended on under all circumstances.

I hope this explanation will satisfy your minds that the gun of the future can be worked on my plan to far greater advantage than on that of the present broadside gun, the only merit of which plan consists in affording a trifle more lateral training, obtained by a great sacrifice of strength to the frame of the ship; by having a weak pivot; and by exposing the guns even to injuries from iron splinters, while the taking up of the recoil entirely by friction, brings all the strain on the pivot and slide: nor it cannot be expected that the very best compressor can be safely relied on after a certain amount of work, especially when fighting in a rolling sea.

Now, by combining the counterpoise weight with the compressor system (and what compressor can be more simple or powerful than the brake on this windlass), and retiring the gun six feet from the side, I think we shall be able to work a 25-ton gun, or one even of heavier calibre on the broadside. Should anything go wrong with the simple machinery I have adopted, there are tackles and breechings kept at the gun ready to be resorted to, though I apprehend if the present slide and carriage were placed in such a predicament, it would be almost impossible to work even an 18-ton gun with such appliances.

of any obstruction, which guns, however, would be quite harmless in rough weather, or even in a moderate sea when steaming head to it.

Now it will be as well to consider, in working the gun of the future on the broadside, whether we cannot introduce an armament for a ship, say 300 feet in length by 64 in breadth, which shall embrace a powerful broadside battery, and combining a perfect all-round fire.

With all due deference to our talented chief constructor, Mr. Reed, I think that if he had built the "Hercules" something after this model (which I by no means say is perfect) the result would have been far more satisfactory, and a considerable expense saved, by adopting the composite system of ship-building combined with my plan for internal armour.

I must premise, however, that the model before you was designed in 1863, with an armament of 24 6-ton guns, since which we have come to 12, and now to 18-ton guns, consequently her former armament is reduced to 12 guns of heavier calibre.

Now an 18-ton gun requires at least 25 feet between each port, and 9 feet head room. On going on board the "Hercules" her battery appeared to me to be very much cramped; her ports, in fact, were only 14 feet 6 inches apart, and the breech of the gun in close proximity to the deck beams. The plan for working these guns appeared to me to be very complicated, and they certainly could not be worked with breechings and tackles, in case of accident to the machinery, like the models before you; while the recessed ports would act as a sort of shoot for conveying shell and other missiles into the battery. The system of pivoting is weak, and exceedingly liable to fracture from the enemy's shot.

I put it to any unprejudiced person here, whether the battery in this model could not mount four 18-ton guns on each side, and three crossing each other from bow and stern, with 25 feet between each gun, and 9 feet head-room, and also possessing the great advantage of the internal armour principle, by placing a 25-ton gun (which, mind you, the turret is now armed with) 6 feet further in-board, and well clear of the seas, which, at the same inclination, would surge the guns of the "Hercules." (Plate VI., Figs. 2 and 3.)

These are points, gentlemen, for your consideration, and it remains with you to express an opinion whether the gun of the future can be carried and worked with ease on the plan I propose, or to decide that it can only be carried in the turret.

My friend, Admiral Key, under whom I have served, and whom, we all know, it is a pleasure to serve under, and to whom I am much indebted for the care and attention he has taken in inspecting my models, is under an impression that my plan for working heavy guns on the broadside is not adapted to the present system of pivoting in the centre of the port, as it precludes the use of the hollow pivot, through which the chain breeching passes, as shown in my model No. 2, and necessitates the port being made larger on the outside.

Now, the only advantage I can see in the centre pivot is, that it gives the gun a small additional amount of lateral training, and having a comparatively narrow port outside, but showing a very broad one inside.

Now, the narrowness of the port outside is very deceptive, so far as concerns the gun and its crew, in affording them protection—for a shot would be sure to penetrate the side which is so much cut away in the beveling, causing innumerable splinters of iron, killing or wounding the whole of the gun's crew, and probably upsetting its complicated machinery.

The pivot, as I previously mentioned, has its weak points also. If a shot should strike the side just below the cill of the port, the only protection the pivot has, is the armour and part of the backing; this, the gun of the present day would be certain to knock away with a single shot, whereas with my pivot the shot must pass through the whole of the ship's side, and then receive a very hard blow itself before it could be damaged.

Now, although my port shows a larger opening on the outside, the inner side is considerably smaller than the port I have just mentioned, consequently I do not cut away near so much of the ship's frame, as the bevel is reversed. My plan, too, for closing the port as the gun fires, completely protects the crew from rifle balls or grape shot, which, to my mind, is of paramount importance when engaging an enemy, who is sure to be provided with the best rifle marksmen. It is a well-known fact that in many instances during the late American war the gunners could not load their guns at a moderate range without being picked off by rifle bullets. My port is of wood sheathed with iron of sufficient thickness to resist either grape or rifle balls.

Now, should a shot come in through my port (which shot would have struck the thin bevel edge of the narrow port, causing innumerable splinters of iron, etc.), it would probably pass through the port on the opposite side of the ship, killing, perhaps, one or two men, but free from the disastrous effects of iron splinters. As regards the pivot in model No. 2, I think there can be but one opinion, which is most to be depended on under all circumstances.

I hope this explanation will satisfy your minds that the gun of the future can be worked on my plan to far greater advantage than on that of the present broadside gun, the only merit of which plan consists in affording a trifle more lateral training, obtained by a great sacrifice of strength to the frame of the ship; by having a weak pivot; and by exposing the guns even to injuries from iron splinters, while the taking up of the recoil entirely by friction, brings all the strain on the pivot and slide: nor it cannot be expected that the very best compressor can be safely relied on after a certain amount of work, especially when fighting in a rolling sea.

Now, by combining the counterpoise weight with the compressor system (and what compressor can be more simple or powerful than the brake on this windlass), and retiring the gun six feet from the side, I think we shall be able to work a 25-ton gun, or one even of heavier calibre on the broadside. Should anything go wrong with the simple machinery I have adopted, there are tackles and breechings kept at the gun ready to be resorted to, though I apprehend if the present slide and carriage were placed in such a predicament, it would be almost impossible to work even an 18-ton gun with such appliances.

My friend, Admiral Key, remarked that my plan would require a vast amount of extra fittings in the ship. Granted, but then the gun carriage and slide would be denuded of its complicated machinery, leaving the balance of cost of difference of fitting in my favour. If we must have these monster guns, depend on it, no trouble or expense must be spared so as to insure their being under perfect control with the most simple appliances of mechanical power, and fit to contend with the rolling of a ship when fighting her guns on the broad Atlantic.

Having thus suggested for your consideration whether the gun of the future can only be worked with advantage in the turret in preference to the broadside, I will, as briefly as I can, describe to you my plan for working heavy guns in the latter position.

The models which I now bring forward, represent a six, and twelve-ton gun with their carriages and slides. In model No. 2 you will observe that although the working of the gun is similar to that in No. 1, the carriage and slide are different. This plan shows that a counterpoise say of one-sixth the weight of the gun would do the duty of running the gun out, while its recoil would be very gentle, as it has not only to lift the counterpoise of two tons, but to force it through an iron cylinder besides raising a heavy port; I am of opinion, however, that the windlass, with a less counterpoise, as shown in No. 1, is preferable.

Model No. 1 I will now proceed to describe:—

When I say that the artificers of any ship could construct such a gun-carriage, or readily repair it when damaged, I conceive that this is its strongest recommendation, as a gun mounted on an iron carriage and worked by complicated machinery on the same deck, is so liable to be disabled.

I consider this point, therefore, as my first advantage.

2ndly. The gun is perfectly under control in the heaviest weather.

3rdly. A 6-ton gun, or one of heavier calibre, could be worked by three men on the fighting-deck, and four on the deck below it, thus lessening the chance of casualties, with a large reserve to fall back on.

4thly. When firing in a line with the keel, and the ship rolling heavily, the gun could not possibly capsize, or get out of gear, while the present carriage and slide could hardly be trusted under these circumstances.

5thly. These carriages are available for those operations, for which the present carriage and slide are inapplicable.

Having thus described its advantages, I may be permitted to explain severally how these are effected.

1st. With regard to its simplicity. The gun is mounted on a common wooden gun-carriage, of suitable size and strength, but its axletrees and wheels are of iron. The slide is placed vertically, and secured to the ship's side, similar to the rudder fastenings of a ship, a suitable groove is cut through the slide from the outer end to within 15 inches of the pivot, corresponding to the height of the axletrees. The open end of the groove receives the gun-carriage, which is then firmly secured by a movable chock with two screw-bolts.

2ndly. The gun is kept under perfect control.

This is effected by having a small windlass, 2 feet in length, fixed on the lower deck immediately under the pivot; the breeching is of chain, which, passing over the open ring at the breech of the gun in a bight, is passed under the gun, and then through a tube $4\frac{1}{2}$ inches in diameter, to the windlass below. Two turns of the chain is taken round the windlass, it then passes through another tube to the orlop deck; the counterpoise is then attached to the chain breeching, which counterpoise works in an air-tight cylinder. The windlass has a powerful brake attached to it, so that when the gun is fired, its recoil would be taken up partly by the counterpoise, and partly by the brake. When the ship is rolling considerably, a lever working on a pivot at the end of the slide, detaches itself as the gun is fired, and firmly secures it from running out again, while, when run out for firing, it is kept in place by the paul of the windlass and the brake.

3rdly. A 6-ton gun, or one of heavier calibre, could be worked by three men on the fighting deck, and four on the deck below.

This is effected by manning the windlass on the lower deck with four men, whose duty besides heaving the gun out, would be to provide cartridge, shot, and wads. The cartridge-box, conveyed by powdermen from the magazine, is passed up a cap-scuttle, 1 foot in diameter, one on each side of the pivot, and handed to No. 3, who, assisted by No. 2, loads the gun; next the shot (kept in racks just under the scuttles) are whipped up by 1, 2, and 3. The shot is placed in a cylinder, slung to a handle working on a pivot, so that when the cylinder is on a level with the muzzle of the gun, the shot and wad is easily tipped into it and rammed home by 2 and 3. No. 1 looks to his lock and sight, and the gun is ready to fire.

4thly. When firing in a line with the keel, and the ship rolling heavily—

This is effected by securing the inner end of the slide by dropping a bolt into a chock, as in model No. 2; the gun would then recoil along the slide with as much ease and safety as when fired from a level platform.

5thly. These carriages are available for those operations for which the present carriage and slide are inapplicable.

This is done by simply withdrawing the carriage from its slide, when it becomes a common gun-carriage, and is capable of being transferred over a moderately rough road.

I have thus, gentlemen, endeavoured to explain model No. 1 in what I consider its advantages, and which I conceive to be equally applicable to guns of heavier calibre, as shown in model No. 2, the principle of working the gun being precisely similar, although the carriage and slide are different. This has also a very powerful compressor, which you will more readily comprehend than I can describe it on inspection of the model. When this compressor is screwed down, you will observe, that so long as the pivot holds on (and it is a strong one), the gun could not possibly capsize in the heaviest rolling sea when firing in a line with the keel.

Now, as it is generally admitted that ships in future warfare will

endeavour to engage each other end on, it appears to me very desirable that the gun-carriage of the future should be constructed with a view, not only to the working of the gun on the broadside to the greatest advantage, but to the ability to fire that gun on a line with the keel with confidence, however deep the ship may be rolling.

I fear I have taxed the patience of my audience, but the working of the heavy gun of the future, and its position, whether in the turret or on the broadside, involves a question of so much importance that I feel I cannot close this paper without some further allusion to the working of heavy broadside guns, present and future.

In the Journal of this Institution, vol. xi., page 67, you will find a paper on the "Working of Heavy Guns on the Broadside," by Andrew A. W. Drew, M.A., from which I extract the following: "Within the last few months I have had the opportunity of inspecting the three different methods of working 12-ton guns on the broadside, which have been adopted for competition in the 'Bellerophon,' but in my estimation they are all open to the following serious objections:—

"1. They cannot give sufficient command over the guns on the broadside in a heavy sea-way to ensure their being worked with efficiency and safety.

"2. They do not provide for any increase of lateral training beyond that possessed by all broadside ships, viz., about 30° each way.

"3. They do not afford so great an amount of protection for the gunners as the ordinary methods, inasmuch as the ports are larger.

"4. The system of pivoting is weak in two out of three of the plans, and exceedingly liable to become deranged in action. The plan adopted by Captain Scott is, no doubt, a good substitute for a pivot, but I do not think it will be found possible to work 12-ton guns in a heavy sea without the use of a *bonâ fide* pivot, much stronger than those in use, and perfectly protected from the chance of injury, and therefore to be depended upon under all circumstances." These assertions were not contradicted at the discussion.

Again, in Admiral Warden's report, he observes that in going to general quarters on the afternoon of the 26th September, "the main deck was flooded with water, the water poured in and out of the guns, two shot rolled overboard out of them, and one was followed by the cartridge. Two of the guns at different times got the better of the crew, and banged in and out of the port several times with extreme violence, and two of the slides were to a certain extent damaged by it. To have opened all the main-deck ports, judging by the effect of only opening five, would have been to have washed the men away from the guns, and consequently they (the guns) would have taken charge of the deck by getting adrift, but with what consequences it would be utterly impossible to predict."

Again, speaking of the turret-ship, "The sea might, and probably would, wash right over the deck of the turret-ship, but the water could be got rid of, whilst here it is not at all clear that it could be got rid of, and certainly not so fast as it would accumulate."

These are startling facts, and show that even a 7-inch gun is a most

difficult machine to manage in rough weather. How, then, shall we be able to control the monster gun of the future?

Now, it is all very well to test guns, and their carriages at Shoeburyness, but the result of the trial is of very little use theoretically speaking, when brought into actual practice on board ship in a rough sea.

On shore, the carriage and slide, with all its complicated machinery, appears a miracle of invention—the whole affair is like clockwork—the compressors take up the recoil, and the monster gun owns itself fairly mastered by the mechanical power applied to it on dry land, but the old fellow, who now lays subdued, whispers to himself, “stop till I go on board ship, and then see if I don’t play them a trick. Now don’t think you are going to rattle me in and out, and firing ever so many rounds as you did at Shoeburyness, until my poor inside was almost a-fire. I tell you I won’t stand it, and although you may squeeze me like as you would a lemon, you will never cure me of my mad propensities on board ship, when old Boreas gives us a pipe from his whistle; but if you retire me further inboard, and ease my movements with a counterpoise, then I promise to behave myself in all kinds of weather, especially as I shall imbibe no more salt water, which does not agree with my vitals.”

Joking apart, these are questions of importance which I have no doubt will receive attention from some of the gentlemen present during the discussion, and it only remains for me to observe that I have done my best to obviate certain defects in the working of heavy guns on the broadside, by combining a counterpoise with friction for more effectually taking up the recoil.

For instance, I do not see how a gun fitted on my plan could take charge of the deck by getting adrift, even if the men were washed from it, and I have certainly lessened the chance of shipping seas through the port, but should a sea come in, I have only to open the cap-scuttles for handing up powder and shot, to clear the deck of any volume of water, which, finding its way to the pump-well, would soon be discharged by the engines.

Those who have brought forward plans for working heavy guns on the broadside, deserve every praise, but as the gun of the future, and the best method of working it, may still be in their infancy, I think, gentlemen, you will agree with me that any person who proposes a plan whereby these monster guns can be brought under perfect control, deserves a patient investigation of his plan when we come to the discussion on it.

According to the title of my paper, I have still some observations to make on a perfect “all-round fire” in rough weather, “combined with the broadside system of armament.”

Now it is easy enough to command an “all-round fire” in smooth water, as in the case of the “Hercules,” which I have already alluded to, but the requirements of a ship-of-war suppose her to be ready to act under any circumstances of wind and weather, and therefore it appears to me to be of the utmost importance that a well-designed plan for a perfect all-round fire, combined with the system of broadside armament, should be taken into serious consideration by the authorities. I beg to

refer my audience to the diagrams on the wall, and the models on the table, illustrative of my views on this subject, and which I will explain presently.

The case at present stands thus—shall we continue to build ships like the “Hercules” and “Sultan,” with high and weak sides, and having a very imperfect all-round fire, while at the same time their batteries are cramped, and their armour inefficient? Shall we continue to expose our men in this confined battery to the bursting of shells, or to the disastrous effects of innumerable splinters of iron? or shall we boldly do away at once with all this extra top-hamper, so detrimental to the iron clad system?

I unhesitatingly say yes, and try in preference other plans, either these hanging on the wall of the theatre, or represented by models on the table.

What was supposed to have been a perfect “all-round fire,” has proved a failure when applied to sea-going ships on the turret principle with low freeboard, and the “Invincible” class have the same defective arrangement in their central batteries, as existed in the “Hercules,” while their upper deck batteries are so weakly defended by armour as to be, I should say, quite untenable under a heavy fire, independent of their objectional position in projecting several feet from the side, which can hardly fail to weaken the structure and cause heavy rolling. Thus Coles’s all-round fire and that of the Chief Constructor, so far as we know at present, evidently tend to prove they are more or less defective, and that we have yet something to learn ere we can produce a perfect and powerful all-round fire, whose guns would be thoroughly protected, and could be fought with advantage in rough weather.

No doubt Captain Coles can design a vessel which will cross the ocean and possess a powerful all-round fire; but when he comes to a full-rigged ship with heavy masts and yards, the case is very different, and clearly proves that low freeboard, whatever advantages it otherwise may have, is not adapted to a full-rigged ship on the turret principle.

For instance, we will suppose the “Captain,” with her machinery damaged, or her screws disabled, has to trust to her canvas, would not the seas, when she heels 12° (which from her want of beam, 53 feet, might reasonably be extended to 15°), wash completely over more than half the deck?

She could not fight her turret to leeward or ahead, on account of her fore-castle, nor could she fire a shot to windward, which would harm the hull of a ship.

This, gentlemen, you will perhaps say is an extreme case, nevertheless, it proves what our steam fleet is liable to, and points out the necessity that, in ocean cruising, our Fleet to be efficient, must be prepared to meet all and every exigency.

As far back as 1837, I first turned my attention to an “all-round fire,” and my models and plans have been before successive Boards of Admiralty since that period.

This model is my original idea for an all-round fire, and you will perceive that there is no point of the compass that a gun does not bear

on, and at the same time my ship can throw a concentrated broadside of five 12-ton guns.

To the original plan I have added a light spar deck, carrying a single turret, the gun of which is more than 20 feet out of water; a style of armament which would have done good service had the Channel Fleet been actually engaged with an enemy on the occasion referred to by Admiral Yelverton.

This deck plan, No. 1, is another system, by which fourteen 18-ton guns are fought in one battery. You will perceive that I can deliver a concentrated fire from three guns directly ahead or astern within 20 yards (Plate vi, fig. 4). The guns are retired 6 feet from the side, and nearly 70 feet from the extremities, and are 16 feet out of water.

No. 2 is the elevation, and shows the position of the bow-gun of the "Hercules" when pitching in a moderate sea. You will observe that under these circumstances, my bow-guns are at a considerable distance from the water, while that of the "Hercules" would be buried. (Figs. 2 and 3.)

Nos. 3 and 4 (Figs. 6 and 7) represent the midship section, showing by retiring the gun six feet inboard that when the ship rolls 20 degrees the gun could still be fought, whereas in No. 4, which represents the midship section of the "Bellerophon" and "Hercules" class, it could not.

No. 5 shows the disposition of the sails in a vessel like No. 1 (Fig. 1). You will observe that her principal mast is stepped at about one-third of her length; this admits the middle bow-gun to fire right ahead, and while the mode of rig is powerful in itself, it would require not only fewer hands to handle it than if she were ship-rigged, but her pitching motion would be remarkably easy.

No. 6 represents a double or twin mast; each mast is 2 feet diameter at the heel. You will observe they are secured to each other at the head by the cap and crosstrees, and at intervening spaces by strong iron bands, which admits of the topmast ascending and descending in the usual manner. The object of this double mast is, that if the ship-rig is preferred to that described as No. 5, the middle bow-gun would still fire with the same advantage through the double mast, strong cheeks of iron being secured to the mast in the wake of the port.

The arrangement with regard to her stern-guns and the mizen-mast would, of course, be similar.

This description of mast would not be heavier than the tripod.

The advantages I claim for my system for an "all-round fire" are the following:—

1st. The guns which command this "all-round fire" are thoroughly protected with 9-inch armour faced with short lengths of chain, hung vertically, removable at pleasure. (Fig. 5.)

2ndly. The guns are always in place, and therefore free from the objectionable plan employed in the "Hercules" and other ships.

3rdly. The battery comprising this all-round fire, combining with it the broadside system of armament, is so disposed as to relieve the extremities and sides of the hull from the enormous over-hanging weights appertaining to the hull of a ship like the "Hercules" and

others; consequently, my plan admits of heavier armour being carried, as well as a heavier armament.

4thly. All the guns being of one calibre and fought on a single deck, the ammunition is more readily supplied, the fighting capacity of the ship is more compact, and the top-hamper of the make-believe frigate dispensed with, and its extraneous weights merged with the heavier armour and armament of the pure iron-clad such as I have described.

Before quitting the subject of an all-round fire, I may be permitted to observe that, as my plan, requiring as it does an increase of beam when combined with the internal armour principle, may draw forth some objections to it, I beg to say that 300 feet \times 64 is by no means an excessive breadth for an ocean iron-clad as a full-rigged ship; and when we consider that this increase of breadth is at the water-line, and extends downwards some five or six feet only, we shall find that the broad ship, although displacing rather more water than the narrow flat-floored ship, her transverse section will meet with less resistance when propelled by steam or sail power, owing to the resistance being confined principally at the water surface and some six feet below it; whilst the flat-floored ship carries it down to her very keel some 26 feet, and this full displacement is very detrimental to steam propulsion by the screw. I have, therefore, no hesitation in saying, that if the "Hercules" had my midship section, she would steam or sail a knot faster than she does at present; and, as for rolling, it stands to reason that a long, rising, and hollow floor, with a moderately deep keel, with armour and guns retired six feet, very materially assists in producing a ship with a steady gun platform.

Now, when we know that none of our first-rate iron-clads can carry more than three or four days' fuel at full speed, it becomes a matter for serious consideration.

Petroleum, I fear, as a generator of steam is of too dangerous a character to be entertained, and therefore true economy consists in making our ships thoroughly efficient in sail power, and of such a construction as to be able to carry a great press of canvas at a slight inclination, so as to be able to do battle with the elements, as well as the enemy.

This I have endeavoured to accomplish by combining my plan for internal armour with the composite principle of ship-building, which gives increased buoyancy to the hull; consequently it is able to carry a greater weight of armour, and this armour with the gun battery is so disposed as to ensure not only a perfect all-round fire in rough weather, but its broadside guns could be fought when ships of the present build could not open a port.

Thus, gentlemen, I have touched on some of the advantages appertaining to the system of an all-round fire, and pointed out the defects existing in the "Hercules," and other ships on that head. Doubtless there are other advantages in the system yet in embryo, which neither I nor any one here can foretell.

Scarcely a year passes ere some well-matured plan is considered almost obsolete. For instance, the Moncrieff gun has thrown into the shade our most modern system of fortification, and threatens to

upset even our Naval armament, showing that Coles's turret and our broadside guns may, ere long, be only talked of as things of the past, and that inventors, to keep pace with the march of intellect, must be possessed of more than a common stock of brains.

This reminds me, before bringing these observations to a conclusion, that inventors who bring their models and plans before this excellent Institution, are invariably treated with the greatest courtesy and attention; and I am sure that my brother Officers will join with me in returning thanks to the Council and its Secretary, Captain Burgess, for their uniform urbanity in all that concerns their department.

The higher authorities, I fear (and this I say with all due respect), often consider us troublesome fellows, and well they may, considering the multifarious duties they have to attend to. Then why not have a Scientific Board of Officers, retired from the service, who with a slight addition to their half-pay would gladly devote their time in examining into all inventions connected with the Navy. Such an arrangement would cost a mere trifle, about £600 a-year, as the meetings need not be oftener than once a month, or so; while, on the other hand, the Controller's Office would be relieved from a most unpleasant duty.

Here we not only enjoy free discussions, but the results very often lead to other advantages, by bringing our inventions to the notice of the Admiralty when they have any merit in them; and even in the poorest invention there is often some good point capable of being improved on. Doubtless the Controller's Department would be rather thankful than otherwise to any inventor who could give them a helping hand by timely introducing certain improvements during the transition state of our Navy, for we may rest assured that it is not in human nature to suppose that the brains of any single individual are equal to the onerous task of forming an ocean-cruizing Fleet to carry the gun of the future on the broadside, combined with a perfect "all-round" fire in rough weather, as well as to meet all and every requirement which the nation naturally demands for so large an outlay of its money.

I have, I believe, now fulfilled my task. I have endeavoured to make my ideas as comprehensive as possible. I trust I have pointed out certain defects in working the present broadside gun, and brought under your notice my plan for working the gun of the future, and improving its position by retiring it six feet inboard. My observations on the "all-round fire" will, I also hope, meet with your commendation, and while thanking my audience for their company on this occasion, I must yet crave their favour in the discussion which follows, rigidly to examine into the principles here advanced on these points. If I succeed in my views for working the gun of the future and improving its position on the broadside, and in introducing a perfect and powerful "all-round fire," I shall attribute my success to the opportunity this Institution has afforded me of bringing forward my inventions before this meeting; whilst, on the other hand, should my plans not be considered feasible, I shall at least have had the pleasure of hearing them freely discussed.

The CHAIRMAN: Would any gentleman like to speak upon the subject, or to ask any questions with respect to the paper which Captain Wilson has just read? I

dare say many of us want information upon some one point or other. For myself, am I to understand that the retired gun, the whole mass of the battery, in short, would be elevated so much higher above the water-line in the one ship than in the other, as represented in those models and consequently more liable to the momentum of oscillation?

Captain WILSON: Yes, her battery would be higher, but her rolling would be less.

The CHAIRMAN: I see that you have a counterpoise there. Every gun, in short, would require a certain additional weight. Supposing the gun to weigh 5 tons, it would require one ton of counterpoise in addition; so that the gun would not be a 5-ton gun, but a 6-ton gun. That would be an additional weight to carry on the ship.

Captain WILSON: Yes, there would be a little extra weight, about half a ton for a 7-ton gun, but the carriage would be of less weight than those in use.

The CHAIRMAN: There is another point I should like to ask about. I do not quite understand about the chain. Is there a working chain that runs the gun in and out?

Captain WILSON: This is the breeching of the gun, and this breeching comes round the windlass below (see Fig. 5), and that runs the gun out (showing). The gun is worked from below.

The CHAIRMAN: Then it will require two decks to work the gun.

Captain WILSON: It will be an advantage. My object is to avoid the exposure of the men by working the gun on the lower deck.

Captain JASPER SELWYN, R.N.: I do not know whether I ought to be one of the first to rise: I think probably not. At all events I am sure those who have listened to the remarks that are made from time to time in this Institution, will confess that, whatever my other errors may have been, I do not generally err in dispraise of new ideas, or in finding fault; and if on this occasion I point out certain things which I consider defects, I trust the author of the paper will believe that I do so in the spirit of a brother Officer anxious to help forward his invention. I will remark first, that with regard to the frame of a ship of modern construction, we are under very different conditions from those which would apply to the frame of a ship constructed of wood. With an iron construction it matters nothing how you cut it, or where you cut it, inasmuch as the whole structure is put together homogeneously, and you may place the strength precisely where you require it, or leave it out where you do not require it. Therefore, those arguments which point to certain portions of the frame being cut away do not in any degree apply to iron ships. There is no cutting away; there is a building up in a particular direction in which we require strength. With regard to the pivots which are claimed to be stronger on this structure than on any other, I say that if a shot enter, those who have seen shot fired with modern guns are perfectly well aware that no pivot will stand the effect for a single instant, if it were not for the fact that our ships are so armoured, that we do not contemplate shot entering at all, except as an exception.

Captain WILSON: You say no pivot will stand it?

Captain SELWYN: I say no pivot can possibly stand, wherever it is placed, if the armour-plate can once be pierced and the shot gets inside the ship: I say it is impossible for any pivot to stand a shot that has been able to get into the ship. Many of our iron-clads are, unfortunately, unable to keep out the shot of the present day. A great many of those now at sea would be perfectly futile if opposed to modern guns. We have made great improvements in armour. As guns have progressed, so has armour progressed; and at last we have devised a structure that will defy some shot, but not all. With regard to the running in and out which Captain Wilson spoke of—

Captain WILSON: There is no running in of mine. This shows, merely, running out the gun.

Captain SELWYN: Pardon me, in this Institution it is the custom to wait until the speaker has done, and it is more convenient. With interruptions, the thread of argument is often lost. With regard to the running in and out proposed here, it is to be remarked that when you are dealing with an incline—and a ship is always a

plane constantly changing its incline by rolling—a counterpoise, which is perfectly practicable and good at one moment, may be utterly impracticable and wrong at another. Secondly, that to apply chains, or any similar apparatus, to communicate the motion of the recoil of a really large gun to weights, is, I am sorry to say, an entire violation of all that we know of engineering. The weight which can be moved in a second of time cannot be moved at all in one-tenth of a second. The chain which will stand perfectly a weight of ten tons hanging from it will certainly require to be one hundred times stronger, in order to stand the strain brought upon it by the sudden recoil of a gun operating over one second of time. It has to lift that counterpoise weight, to set it in motion, and it does so with a tremendous strain upon the chain, which we can only call a jerk, but of which we have never been able to calculate the exact laws. That jerk increases and varies as you continue your fire. The gun gets more heated, the gases expand more freely, the recoil increases in power, and it is no uncommon thing to see guns flying in and out again under such a strain. Therefore, it becomes extremely difficult to apply a suspended counterpoise in this way, where the principle of leverage is not called into play, where the strain is transmitted direct from the gun on recoil to the weight to be lifted. Wherever we introduce the principle of levers, there we introduce also the element of time, the weight to be moved, passing through a larger periphery than the gun recoils, and having also a longer time to move; and we get in there the question of time, which is a most important one in considering strains. That the artificers could repair any of our modern gun-carriages without the appliances which we have not, and cannot have on board ship, steam-hammers and lathes to turn an axle, for instance, or furnaces to cast a truck, or to do anything else that is required for large guns, is an expectation that I am afraid would be found a failure in practice. We cannot expect it to be done. It is only by the use of machinery such as we see in our great factories that we can hope to turn out any of the essential parts of a modern gun-carriage on board ship. To return to those structures of wood which resisted the strains of our former ordnance, but which would be utterly incapable, and which have been proved to be utterly incapable to stand those of modern ordnance, would, I am afraid, be a retrogression and not a progression. With regard to the training of guns, I must point out, as I have pointed out once or twice before in this Institution, that the instant we get a good motive power well into operation, the training of guns becomes a very much less serious question than it is now even supposed to be. The twin screw will train a gun more quickly than any crew can do; the hydraulic propeller will also do the same thing. The training of the guns themselves matters very little indeed, except for the purpose of concentration at short distances, which do not require a very great arc of training. Inasmuch as we do not ordinarily fire in that manner on ships far removed, far ahead, or far astern of us, we do not require that power of training, because we are able to change the direction of the ship, and in this way bring the gun to bear, without losing any of the advantages of the twin screw or the hydraulic propeller. We, therefore, think we secure the object in view better by this means than by either widening the ports or providing, by other means, for a great arc of training. When we add to this the fact, that a great arc of training necessitates one of two things, either that your rigging, as in the case of turret ships, should be nearly absent or be prepared to be shot away, or that you should retire your guns beyond their most effective position, it will be seen that we had better go on with and improve some of our modern ideas than go back to the old system which would have these disadvantages. A port is a weakness in a ship which no one will deny. It is a weakness in a fort and a weakness in a ship; and we can never get rid of it entirely unless by some such plan as Captain Moncrieff has invented for forts, which does away with the necessity of ports altogether. The fighting end-on I confess I have never regarded as being an important part of the duty of future ships. That they may occasionally be called upon to fight end-on, I have no doubt; but it would be the merest folly to throw away the power of the broadside for the sake of pelting your enemy with one or two shots while you are approaching him end-on. Occasionally, no doubt, it will be most useful to have the power in chasing or retreating, if retreating be ever brought into operation. I have said something of the things which

Captain Wilson has failed to do: I shall now proceed to mention some of the things which he has done. This is one of the first proposals I have seen for the making of what I may call internal armour, or "close quarters." It differs from the turret in the fact that it is not movable; that it has a power of fighting both broadsides at once; and it has the immense value that the area of the armour is considerably diminished, and, consequently, the weight to be carried is diminished *pro rata*. The thickness of armour may be greater in such a ship, because the armour is not put so much on the outside of the ship. But there is a most important point of difficulty which I beg Captain Wilson, in his answer, will attend to. We have always found that in the turret system, or anything approaching to it, it is necessary to provide one special armour for the gun and its crew, and another special armour for the ship, in order that she may not be sunk. It is clear that if the hull of the ship be considered as external to the armour, and there be a space there into which water can go, we shall have shot passing through the outside skin, and then striking the internal armour. That will produce a very curious effect, in that no one will be able to see what damage he has done from the outside. He will see that he has pierced a hole through the skin, but he will not know what he has done with the armour plates. But it has this other disadvantage, that I am not clear at all that the floatative power of that vessel, after water is admitted from the outside, will be sufficient to support the extremely heavy weights that remain inside.

Captain WILSON: The space between the outer skin and the internal armour is all filled with cork.

The CHAIRMAN: I think it will be more convenient to let Captain Selwyn finish what he has to say.

Captain SELWYN: The provision for rigging seems to me liable very much to the same objection as in turrets, unless it be proposed to diminish the width which the rigging occupies, and, consequently, the support to the masts. As we decrease the spread of our rigging, so we decrease also the support which we give to the masts. I am supposing that the rigging is taken to a point inside the armour line. The idea of a double mast is one which I should be very much afraid of. I have seen the effect of the flash of guns on the cheeks of an embrasure lined with iron; I know what its effect is on a deck covered with iron, and I should be very reluctant to fire a gun between two masts placed closely together outside the port. I think even if the gun was never fired except in the direct line of the keel, there would be a certain amount of danger to those masts, and if it were attempted to train the gun at all I am quite certain it would become serious. Next, as to the question of rolling with a long rising and hollow floor, I have had the honour of commanding one of Symond's best ships, and I do say that I did not find their rolling qualities in the least degree diminished by that fact. I must say that I admired them very much, they were a great progress over what we had had for many years before, in speed and in many weatherly qualities, yet I cannot say that in rolling there was an improvement. And I do say, as regards the idea of a peculiar midship section but the same displacement operating favourably or the reverse, I am afraid that Captain Wilson is at loggerheads with the naval architects, and with the mathematicians of the day. We have learned to our cost that to build short ships with the view of making them handy is to call for more power to drive them, and to call for more power to drive them is to shorten the life of the driving power. We cannot avoid it, we have no means at present of avoiding it, except by that very material of which I am an advocate, and, therefore, I may be fairly called upon to say a word about that which Captain Wilson "pooh-poohed" as being too dangerous. Now, I am not an advocate of petroleum, I have never been, I am an advocate of liquid fuel, under the form of creosote or heavy oil, and I can assure Captain Wilson that it has not the slightest explosive quality; I defy him to explode it in any way. It is far less dangerous than train oil, inasmuch as it will sink under water, which train oil will not. This does give the power for which Captain Wilson proposes to substitute sails. But I would venture to ask how he proposes that the sails should operate against wind as well as with it, and whether he would like to find himself opposed to an enemy moving with full power against a breeze, while he himself relies upon sails? I admit the great value of armour inside the ship instead of outside. If we can only put it

inside the wood, if by any device we can make that wood incombustible, or render it less liable to strip off, the interposition of wood would necessitate the slowing of the shot before it strikes the armour, and the shot will have its hardest work to do after it has pierced the outside, which is more in accordance with the scientific disposition of the strength required from armour. I shall be happy to hear how the objections can be answered that I have adduced, with regard to the vulnerability of the outer hull of the ship.

The CHAIRMAN : Would any other Officer make a remark ?

A VISITOR : Did I understand you to say the vessel is 60 feet beam ?

Captain WILSON : 65 feet beam.

The CHAIRMAN : Perhaps Captain Wilson you will now reply to Captain Selwyn's remarks.

Captain WILSON : Captain Selwyn considers that no pivot can be secure with the guns at present in use.

Captain SELWYN : Yes.

Captain WILSON : With the way in which ships are armoured now, he thinks the shot will penetrate, and that the pivot, although it is inside as it is in mine, runs the same risk of being knocked to pieces as one that is about half way in the ship's side. I think that is the statement he made. I should say that this pivot is in a position where it would never be damaged. There is a 9-inch armour outside it and the usual backing, and if the shot were to go through all that, its powers would be dispersed before it reached the pivot. That is my answer to that statement. With regard to the running in and out of the gun, Captain Selwyn seemed to suppose that this chain breeching will have an enormous strain upon it. But when it draws up the counterpoise weight, if the break on the windlass is applied by a careful hand, that will perfectly control it, and you can stop the gun almost at once if you like. That is my idea of the plan. The chain, I should say, would, of course, be quite equal to bear that strain, much more secure than by merely trusting to the friction of the gun on recoil. With respect to repairing the gun-carriage, I think Captain Selwyn expressed an opinion that an iron gun-carriage could not be repaired on board ship.

Captain SELWYN : I did not say an iron gun-carriage, I said any gun-carriage.

Captain WILSON : I beg your pardon, I understood you to say so. It is only a difference of opinion. I say a gun-carriage, if it is made in proportion to the strain of the gun, and is strengthened and breasted with iron, it is not a common wooden gun-carriage. I should say that that gun-carriage would be more to be relied upon than any other gun-carriage, and those gun-carriages we know can be repaired on board ship. And if a shot comes in and strikes a gun-carriage, the chances are that it will do very little harm as far as splinters go, and we know that splinters from iron are doubly more injurious than those of wood. With respect to training the guns, I perfectly agree with Captain Selwyn, that that is a matter of secondary consideration. I think by a judicious management of the helm, and with the assistance of twin screws, that very little training will be required for guns. If I was working these guns I should not attempt to train any of them, I should merely watch the helm and bring them on. Fighting end-on was the next point alluded to. I understood from Captain Selwyn that he does not consider fighting-end on of so much importance as I do, and that he would prefer the broadside to the end-on fire. Now I entirely differ from that view, because if you were bearing down on an enemy with a fleet of ten sail of the line armed in this way, you would have three 18-ton guns from each ship to bear as you approached the enemy, and if you were obliged to retreat you would have the same power available. Captain Selwyn agrees with me, I think, about the internal armour, but he is under the impression, I fancy, that the space between the outer skin and the armour is entirely open. It is not so, it is filled with cork, closely packed, all below the water-line. The upper part is entirely open, and, of course, if a shot came in there the water would always run out of the same shot hole. My object in filling the lower part up with cork, is with a view to the possibility of being rammed. Here is a model of Mr. Reed's ram-bow, the bow of the "Hercules," and here is my midship section. You cannot touch the bilge of my ship with the ram ; the side may be stove in, I grant, but still the ship cannot

sink. That is an immense advantage, for any other ship would sink. In the "Hercules" you see there is nothing to stop the ram from going right through the bilge, the most tender part of the ship. The next point was with regard to the spread of the rigging. The ship being 65 feet beam, her rigging would have quite sufficient spread, as much as the "Hercules" would have. There would be about the same, I should say. That is my answer to that point. I am not at all an advocate for the twin masts. That is the rig I would prefer (see Plate vi, fig. 1).

Captain SELWYN: For what size ship is that?

Captain WILSON: For this vessel.

Captain SELWYN: For 6,000 tons?

Captain WILSON: No, for 4,500 tons. She would have the largest sails here (pointing), the largest sail we have in the Navy. This would be about the size of the foremast of a first-class frigate. If the twin masts were used, you could protect them with very thick shields of iron. I do not apprehend there will be the slightest difficulty in firing through the opening between the masts—not the slightest. You might put iron as thick as you like upon it. Captain Selwyn also spoke of the rolling of the Symondite ships. I have been in several Symondite ships myself, and I beg to say that mine is not a Symondite ship. My midship section is nothing like that of a Symondite ship. The Symondite has not a hollow floor. In small vessels the Symondite is perfectly straight: in the larger ships the floor rounds out a little. The reason why the Symondite vessels rolled as they did, was their want of length. When Sir William Symonds built those ships, he was confined as to length; he could not build a ship beyond 205 feet long. My ship is 300 feet long, with a long hollow rising floor, carrying her beam a long way down past the water-line. I should say the rolling of that ship would be very easy; I do not see anything to prevent that ship being an easy ship. Short ships with full floor would certainly require more power; but I cannot agree with Captain Selwyn, or with anybody else he may be a naval architect, upon another point. I maintain that if you decrease the displacement a certain depth below the water-line, the ship will steam or sail faster, although she is a broader ship than one of the same length. It stands to reason, there is not half the resistance in the one case that there is in the other. How can there be? Does not the water come more freely to the screw with this rising floor. There can be no doubt about it. With regard to liquid fuel, I must say that I have no knowledge of the subject myself; I only speak from hearsay. I have understood that liquid fuel would be a dangerous thing to have on board ship. At present I do not see that we have anything to trust to but coals for raising steam. We know that coals will not last beyond a certain number of days; therefore, my idea was to give the ship all the power you could with canvas.

Captain SELWYN: Will you allow me to say, that I speak from actual experience with the fuel that I have mentioned. I have burned many tons of it.

Captain WILSON: With regard to the vulnerability of the outside, I do not dispute for a moment that that part would receive considerable damage. If, by carrying heavier armour inside, 9-inch armour, round your battery in every part of your ship, you can keep shot out, while another ship cannot keep it out, there must be an advantage on the part of my ship, which will more than counterbalance any damage that may be done to the outside skin. Mine is a better arrangement than to have the armour outside, and then to find that the shot goes right through the side, with nothing to keep the water out at all. When a shot goes right through the side and makes a tremendous hole, you cannot plug it up as you can in a wooden ship. I do not see that anything can be said against that part of my scheme. I think I have now answered all the objections that have been raised.

Captain SELWYN: I understand you expect the cork to keep out the shot?

Captain WILSON: Of course the cork will have the effect, if it is closely packed, of deadening the force of the shot before it strikes the armour. The armour is inside the cork. The space between the armour and the outside will be filled entirely with cork right along from top to bottom. Cork is a very durable thing. If you look at a common fisherman's net, you will see that the cork will remain for years and years, as good as ever. The commonest cork will do; you may jam it in as tight as you like. In case of being rammed, which promises to be one of the

modes of warfare in the future, if you can save your ship from sinking by the use of cork, you will have gained a great advantage.

The CHAIRMAN : We have to thank Captain Wilson for this opportunity of seeing a new plan. We may have our own opinions about it. For myself, I think there are many details there with which I should not agree. But it is one of those schemes with respect to which we must say the proof of the pudding is in the eating. With my present knowledge, I rather doubt about the gun, and about the recoil, and about one or other points that Captain Selwyn has mentioned. But with regard to the main point of putting the armour inside, I think that is a great advantage, provided we could always prevent the outer skin from being the means of the vessel getting water-logged and sunk in that way. Did you say that the ship is armoured outside?

Captain WILSON : No. She would not be water-logged, because she is filled with cork up to the water line ; so that if the water came in above the water-line, it would run out again. I have calculated that supposing the compartments were filled, it would bring her down 8 inches, and no more.

The CHAIRMAN : There is one point in which we might so far agree with Captain Wilson, that it would be desirable if the authorities were to investigate these things a little more. They cannot always do that. But I am afraid that we shall not, in our day, see a board appointed that will examine all inventions that may be brought before them. The current goes in the other direction, in the way of reduction with the authorities. Therefore, I do not think we shall see that hope of Captain Wilson's realized. However, there is one point in which we may all agree, and that is in thanking Captain Wilson for having given us the opportunity of seeing this plan ; and, if we do not agree with him in all its details, we have, at any rate, learned a lesson from it, which may some day be turned to account. We are very much obliged to him for reading us his paper.

Ebening Meeting.

Monday, February 15th, 1869.

ADMIRAL SIR HENRY J. CODRINGTON, K.C.B., in the Chair.

NAMES of MEMBERS who joined the Institution between the 1st and 15th February, 1869.

LIFE.

Nicolson, C. A., Lieut. R.N. 9/.

Crealock, J. North, Capt. 95th Regt. 9/.

ANNUAL.

Daunt, John C. C. **V.C.**, Capt. Bengal Staff Corps. 1/.

Roe, Herbert F., Paymaster R.N. 1/.

Hay, J. C., Capt. 92nd Highlanders. 1/.

Bridgeman, Hon. Francis C., Lieut. Scots Fus. Gds. 1/.

Scarlet, Leopold J. Y. Campbell, Lieut. Scots Fus. Gds. 1/.

Babington, C. W., Lieut. 9th Bengal Cavalry. 1/.

Huleat, Hugh, M.A., Chap. R.N. 1/.

Leigh, H. M. C., Capt. Gren. Gds. 1/.

Ranfurley, Earl of, Lieut. Gren. Gds. 1/.

Roberts, H. B., Major Roy. Marine Art. 1/.

Hamilton, Charles Edward, Lieut.-Col. 80th Lan. Rifle Vols. 1/.

Campbell, F. Lorn, Lieut. Scots Fus. Gds. 1/.

Kennedy, A. F., Com. R.N. 1/.

ON DEFLECTING-ARMOUR-PLATED SHIPS FOR COAST DEFENCE.

By **MR. J. M. HYDE.**

THERE is no subject of so much importance, and so necessary to the existence of England as a first-class nation, as that of its Navy. The insular position of England gives her a security that can only be assailed by a naval force, and hence the importance of her possessing an efficient and well-appointed Navy.

“Naval affairs” often form a subject of discussion. Indeed all parties admit that England should be in possession of the best and most powerful fleets; her marine, her wealth, her intelligence, and the position she has held, demands it, and however much it might be the fashion for some to underrate this necessity, sad indeed would be the day when this particular arm of the United Service should be neglected.

In the early naval fights of England, sailing ships alone were used,

and to the skill and daring of our seamen are we indebted for those grand and glorious victories we are so proud to remember. The introduction of steam has, however, so changed the entire system of naval tactics, that in all future engagements, the engineering element must form a most prominent feature. Wooden ships and small guns have had their day, and in discarding them we must not forget the duties they have performed, but rather confess that our present knowledge has been accumulated from the experience they have given.

In passing from wooden ships to iron-clads, there is a step so profound, so immeasurably distant, that we can hardly imagine the change has been introduced in so short a time. The sailing of the Baltic fleet in the early stage of the late war, comprising such a host of grand and splendidly equipped ships of the old type, a fleet now only existing in history; and the sailing of an experimental squadron of iron-clads within the period of a few short years, not only exhibits the power of England to obtain, but also the possession of a great amount of skill and intelligence to design and produce a class of ships, so vastly different in form and in material, and yet so necessary for the altered circumstances of the day.

The general application of iron as the material for the construction of the hulls of all ships, whether for war or commercial purposes, has so many advantages, and is now so universally adopted, that nothing need be said on that point; but the production of ships with armour plates is of such recent date, and yet the necessity is so obvious, as to produce astonishment at its not having received earlier attention. The continual improvement in modern artillery and projectiles has certainly produced this necessity, for without some such protection it is obvious no ordinarily constructed ship could possibly swim after receiving the first concentrated broadside, and an engagement under such circumstances would be a momentary fight of extermination; armour-plates, therefore, became a necessity for defence.

The extraordinary manufacture of these plates ought not to escape our notice, and there is no English manufacture that so forcibly exhibits the skill and power of Englishmen, their machinery, and their perseverance. These plates are now produced certainly up to 15 inches thick, and this thickness can doubtless be exceeded, if desired. The object of deflecting-armoured ships, however, is to dispense with the necessity of using such heavy plates, as I hope to be able to explain to the satisfaction of the members of this Institution.

Modern gunnery has had a large amount of science and ingenuity given to it in the production of the various arms, both large and small, which we now possess. Science is as important, however, in defence as in assault. In olden times, individuals in self-defence covered themselves with coats of mail, upon which the blows or projectiles of an enemy were received; this armour doubtless deflected the thrust or cut of the sword, and gave the combatants opportunities for displaying that great skill in arms, of which history records so many brilliant examples.

We often read, too, in more modern times, of hair-breadth escapes caused by the deflection of a shot from the metallic accoutrements

of our soldiers; such cases are familiar to those who have knowledge of actual war. There is, perhaps, no modern case of such grave importance, and affording such singular proof of the advantage of deflection as the case of the recent attempt on the life of His Royal Highness the Prince Alfred; had not the ball of the assassin been most providentially fired obliquely, and hence deflected, the life of His Royal Highness must have been sacrificed. We must all, therefore, rejoice that by the deflection of the shot, we were certainly saved a great national calamity.

The armour-plates first applied to ships did not, I believe, exceed 3 or 4 inches in thickness; these have been gradually increased as the guns have improved. There is, however, no occasion to recapitulate the numerous experiments that have been made both in shields and guns up to the present time; those interested in the question must have read the results given from time to time in the public papers. Numberless have been these experiments, and the results of the contest between the guns and the armour show the deep importance of the question. Between the 4-inch armour of a few years since, and I may say the 14-inch armour of the present day, there is certainly a great stride. To arrive at this thickness, endless experiments have been carried on for many years past at a vast expenditure, and the grand result may be said to be centred in this one fact, that a chilled shell from a 600-pounder gun will penetrate a 10-inch plate and pass through it. This is certainly a fact beyond dispute, as is shown by the firing at Shoeburyness; and even a 15-inch plate has been broken up by such projectiles. Of the practicability of building ships to carry even thicker armour than of 15 inches, I am bound to admit, but as to their cost, stability, and seaworthiness, without investigation I dare offer no opinion. The gradual development of any system that presents a chance of success, if economical in construction, seems more desirable. With this object in view I have, since the year 1853, made numerous experiments and designs for armour-plated ships on the principle of *deflection*, feeling quite sure that any vertical structure that can be carried by a ship of reasonable tonnage will be penetrated by modern artillery; however ingenious that structure might be.

All the artillerists of the present day are agreed upon this point, and however unpalatable the truth, it cannot be disputed; those who saw the practice against the 15-inch plates recently at Shoeburyness, must have seen that vertical armour-plates, even of that thickness, would stand but small chance against the skill of the Woolwich gentlemen; the shot buried itself 11 inches in the material of the plate, and a shell so striking, exploded and blew off a large segment weighing some tons. There were two of these plates fired at, one of them hammered, the other rolled, and both produced with great care by the most celebrated makers of the day; yet both were destroyed, broken up into large fragments. Had these huge plates been hung on the sides of a ship and assailed by similar guns, the result would have been the same—certain and positive destruction to the ship receiving the last shot. If 15-inch armour can be so broken up, what then is the use of hanging 6- or 7-inch plates on a ship's side? The question is natural.

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HYDE'S
Double deflecting Armour-Plated
screw propeller designed to have
any draught of water and steady
even Platform.

Fig. 1.

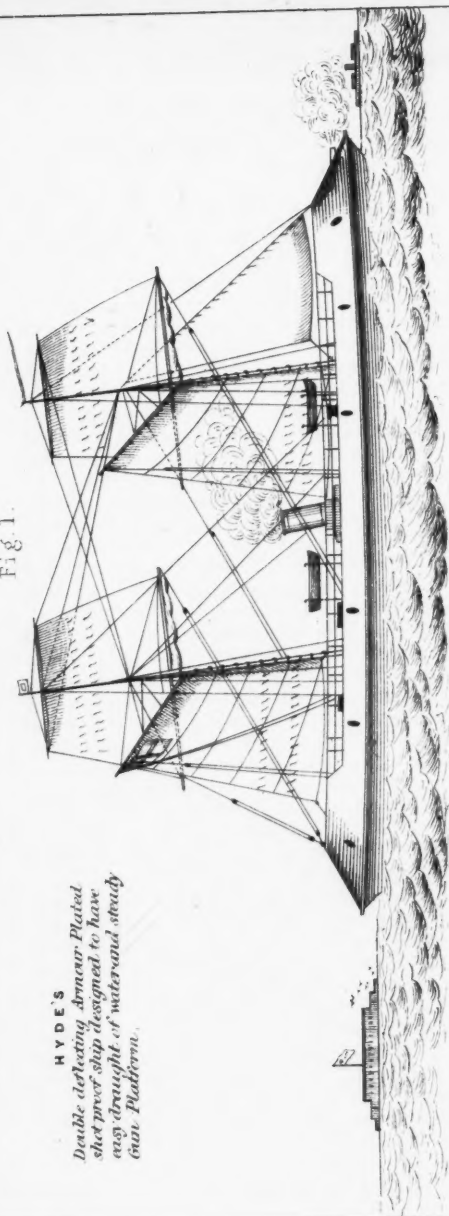
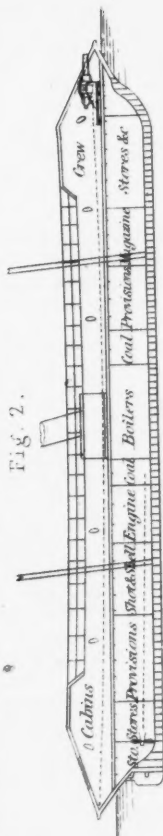
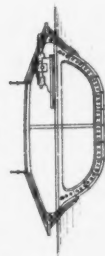


Fig. 2.



Longitudinal Section.

Fig. 3.



Midship Section.

We sometimes hear it said that all naval powers are alike in this respect, and this is offered as some consolation. In these modern days of keen competition, circumstances rapidly change; what is new to-day is old to-morrow, and the race must still go on until the time shall arrive when all men will be of one mind, and will not only agree to use no explosive bullets, but to use no bullets at all. Until that day does come, however, we must still be prepared and so prepared, as to be able to meet every possible contingency. What then can be devised to "keep out these direful shells?" Obviously, deflecting sides. Vertical structures must either be made so thick, and of such rigid material, as to stop by main force a projectile moving at the rate of 1,300 feet in one second of time, or they will be penetrable, and thus useless; whereas deflecting sides, if at an angle sufficiently acute, will cause a projectile to ricochet from its surface, and expend its force in the atmosphere, or in the sea, instead of in penetration. This fact is certainly well known, and has often been alluded to in the description of some modern ships. For instance, I have noticed that lighter armour-plates have been used in places where shot can only hit at an angle, as under the counter. Again, some ships are especially designed for *end-on* duty, that a small section only may be presented to the enemy, and this a curved or angular surface. Deflecting-sided-ships may be said to be *end-on all round*; and, in a general action, would offer no point for special attack, and therefore possess an immense advantage over the ordinary *end-on* ship, which is open to be penetrated at the stern and on the broadside in a general action.

I have heard some gentlemen argue the great importance of the ram as a means of offence, and doubtless a ship of 3,000 or 4,000 tons, steaming at the rate of 12 or 13 knots is capable of doing great damage in the event of a fair hit. My deflecting-sided-ship, I have no hesitation in saying, is proof against this very modern naval operation of ramming. The horizontal rib, extending all round the hull, quite prevents any injury from ramming. This projecting rib of solid metal 18" deep, is a safeguard no other ship possesses, an arrangement in the design of a deflecting-sided-ship of the greatest value. Armour-clads, ramming at each other, are not unlike animals butting at one another when engaged in deadly strife. This is certainly not a very dignified operation, the one being a fight of physical, the other of mechanical force, a mere pugilistic encounter, in which science forms a very secondary part; but so long as ships are made to ram, certainly others should be constructed to resist that operation.

Model No. 1, represents an armour-plated double-deflecting ship, designed for coast defence. The extreme length of this vessel is 255 feet, extreme breadth 60 feet, breadth at water-line 50 feet, depth of hold 13 feet, height between decks 7 feet 9 inches.

I need not say these particulars may be varied to suit circumstances, thus the beam and depth may be increased to admit of arger stowage of coals, and would be a simple matter of calculation.

The profile drawing (Plate vii., fig. 2), will show the internal ar-

rangements of such a ship, among which I particularly wish to notice the large deck accommodation for the crew, entirely above the water-line, so that there would be no occasion to pump in the vital air to the crew, as they do in coal mines.

The drawing fig. 3 is a midship section of this ship. One of the peculiarities of my system is the external application of timber to protect the armour. This I have found by experiment to be the true and proper place for a timber lining, and it forms an important feature in my plan. The external timber cushions a projectile, and in this case alters its line of flight before it reaches the metal plates. The shot in passing through this timber carries a portion of the compressed fibre of the wood before it, and thus distributes the force of the shot over a larger base than the apex of the projectile, upon which the whole force of the work to be done is concentrated. Although this is self-evident, yet mere assertion in this practical age can make but small progress unless supported by actual experiment. I have therefore made a series of experiments to illustrate the principle of *deflection*, the results of which are here, and, with your permission, I will hereafter explain them. Hitherto artillery and target experiments have been carried on at very great cost, in consequence of using the actual full-sized guns, targets, and ammunition. Now, as that would be entirely out of the question in the case of a private individual, and as the difficulty of using for experiments, material belonging to the State is equally out of the question, it occurred to me that a fair result might be obtained by reducing all the elements in an experiment to a scale. These so reduced, would then be within the power of any one. Instead, therefore, of firing at full-sized targets, with a full-sized gun, I reduced the entire system to a scale of 1 inch to the foot; and, although it may appear remarkable, I have obtained similar results to those arrived at with the large guns and targets, as I hope shortly to explain.

But to return to my ship. The midship section, fig. 3, shows the usual construction of war ships as regards the bottom; this is cellular, having an outer and inner skin, with various water-tight compartments, the sides however are sponsoned out as shown, to a point some 3 or 4 feet above the load line; from this point the top sides fall in-board, at an angle of about 20° , the two angles combined not exceeding 45° . The mode of securing the armour plates to the inner skin is by bolts in the usual way, but the armour plates are riveted together at the apex of the angle where they are flanged for that purpose; these flanges are 18 inches deep, and when thus fitted together, form a mass of metal, so arranged as to be not only difficult to hit, but when hit, the metal to be disturbed is so large in quantity as to be equal to withstand even a 600-pounder. Upon the outer surface of this armour, I place a timber facing, as is shown in the drawing; this timber, if 1 foot in thickness, will offer for penetration in the horizontal line a thickness of 30 inches, assuming the projectile would pursue a straight course. That, however, is really not so, as the timber when placed at the angle adopted, causes the shot to ricochet somewhat before it comes to the metal; it thus receives a

curved motion, and is therefore the easier deflected when contact is made with the metal.

These angles are continuous all round the ship, and if the beam and length were the same, such a craft would be of course circular—hardly a ship-shape form of construction—but equally shot proof, if made oval as in the shape suggested by this design, or circular, as suggested by Mr. Elder, in a paper recently read by him at this Institution.* As a practical proof of the advantage of an external facing, I selected two $\frac{3}{4}$ -plates, one a naked plate, and the other faced with 1-inch timber representing 12-inch in the full size. The naked plate was the first fired at, and the result, as you see, was perfect penetration. In this experiment the same shot, charge, and range, were used as in all other experiments. In the second experiment on the plate faced with 1-inch timber, with the same weight of shot, charge, and same range, the result was very different indeed; the timber of course was penetrated, but not the plate. Now this is easily accounted for with round-ended shot, the fibre of the timber is compressed under the blow, is in fact condensed, and must be almost of equal density with the metal itself, the powder force is therefore distributed over a base equal to the area of the shot, and hence the resistance of the plate so protected. With a pointed shot, however, the result is different, deeper injury, but not actual penetration. These experiments clearly show the importance of placing a timber facing on the *outside* of armour plates as well as on the *inside*.

The gun I used in these experiments represented a 600-pounder on a scale of 1 inch to the foot. The 600-pounder gun is known as a 12-inch gun weighing some 23 tons; the bore is 12 inches in diameter. Reducing this to a scale of 1 inch to the foot would make the bore exactly 1 inch in diameter. The shot of the full-size gun is 18 inches long, this reduced to 1-inch scale, would, of course, be $1\frac{1}{2}$ inches, and the full charge of powder represented by a cartridge of about the same length. Now the experiments at Shoeburyness have shown that a shot from the 600-pounder gun has penetrated a 10-inch plate. I have seen the holes in a 10-inch plate, and there is no doubt of it, and in making my experiments, I have taken the proportion of 1 inch to the foot all through. In my targets, a 6-inch target is represented by $\frac{1}{2}$ -inch plate; a 9-inch target by $\frac{3}{4}$ plate; a 12-inch by 1 inch; the range too reduced from 70 yards was some 17 feet—thus the gun, the shot, the powder, the target, and the range were all reduced to the same scale, and the result was the same, viz., that my target representing the 10-inch plate was penetrated as the 10-inch plate was with the big guns. The experiment is of equal value, but was of infinitely less cost, and I may be pardoned for holding the opinion, but I believe that very great and important results may be obtained by carefully making such experiments upon a reduced scale, and thus save a vast sum to the State. In the one case the result of penetrating a 10-inch plate was obtained by the expenditure of many thousands of pounds, in the other of a few shillings only.

* Vide Journal, vol. xii, page 529.—Ed.

Having thus found that a 10-inch plate can be easily penetrated, we may fairly argue that even thicker plates would be in the same condition with bigger guns; indeed the gentlemen at the head of the Artillery Department, all say that they can penetrate any plate that can be produced. Where then is to be the limit, what the cost of ships equal to such elements? what the risk and cost of navigating them, if compelled by modern artillery to carry such armour? Is there no other system of construction? Yes, by deflecting the hostile shot, since it cannot be kept out. Let your ships be made in the form of these models, and the result will be invulnerability; ships shot-proof all round from stem to stern; no weak points at the ends, as well known to any possible enemy as to ourselves; ships proof against that very modern evolution of ramming; ships with an uninterrupted deck *above* the water line, thus rendering it unnecessary to support the crew with *air* by artificial blowing machines; ships easy in a sea-way from the buoyancy given them by the sponsoned sides. Now, in proof of the advantage of the deflecting-side, I have constructed a target to illustrate the effect on a ship. This target is made of homogeneous metal, tempered by a peculiar process, it is riveted together just as the sides of an actual ship would be, and has been faced on the outside with timber to act as a cushion to the shot before it reaches the armour plate.

This target, representing the side of a ship, has been fired at with the same shot and charge as were used in the other experiments, and fairly represents the effect of a 600-pounder on such a ship, and the result, as you see, is partial destruction of the timber, but no injury to the metal beneath. This experiment gives a result I am certainly justified in claiming for a similar experiment if made against the actual ship's side, and clearly proves the vast and immeasurable advantage of this system of construction over any other yet suggested.

It has been urged by some gentlemen who have seen these models, that deflecting-sided ships fitted with turrets, would be the most perfect and apparently the most efficient ships that could be produced. To make a model turret and fire at it with even a model gun would occupy considerable time and add much to the cost of my experiments; but it would most certainly be alike satisfactory to the advocates of the turret-system to have it tested by the largest of our guns, and also to the tax-paying public to be assured, that the sums to be expended in the construction of turret-ships would be so expended with some chance of success in actual war. Of the wisdom of leaving so grave a question in doubt, I offer no opinion; I may, however, express a hope that abler men will be led to urge its deep importance upon the attention of those who have the power to order a full and careful investigation into the entire system. I may add the singular fact that I have never yet been able to find a thoroughly practical mechanic, when called upon to give his real non-official opinion, that is, the true and candid expression of his judgment and experience, upon the turret and its machinery, but who has invariably expressed a *doubt* as to its capability of withstanding the rough usage of war when assailed by big guns. I pray that so direful a calamity may never happen to this

country as the failure of the system so generally adopted, when too late to alter it.

I have extracted from a work recently published by "Von Scheliha" on "Coast Defence," a list of the armour-plated turret-ships of the United States engaged in the attack upon Charleston in 1863, and the effect the Confederate guns had upon their turrets. From the official report it appears that there were 9 of these ships engaged in the action; of these, 1 was sunk, 3 withdrew out of action, and the remaining 5 had their turrets all injured and jammed.

United States Armour-plated Turret-ships engaged in the Attack on Charleston, 1863.

"Weeshawken," *turret injured*, went out of action.

"Passaic," *turret jammed*.

"Montauc," *withdrew out of action*.

"Patapsco," *turret jammed*.

"New Iron Sides," Admiral's ship.

"Catskill," *withdrew out of action*.

"Nantucket," *turret jammed*.

"Nahant," *turret jammed*.

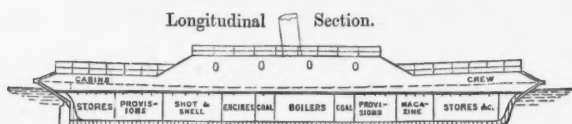
"Keokuk," *sunk*.

These reports all appear under official authority, and are detailed reports of the individual Officer in command of each ship, and are embodied in the report of the Commander-in-Chief to the Secretary of State, and are most authentic records of a very important action, and certainly ought not to be lost sight of. If all future war-ships were only armed with 68-pounders there would perhaps be little difficulty with the turret system, but when 300, 600, and even 1,000-pounders will be the most probable guns of the future, then it would certainly be only fair to test a turret with a few 600-pounder shots before committing the Navy of England to such an untried system.

Ships of my construction would answer the purpose of forts moored in particular harbours, and at the same time would admit of their going to sea.

The application of Messrs. Dudgeon's system of twin screws with independent engines, which is now so universally copied by builders of war-ships, gives such craft an opportunity of manœuvring to the best advantage. It might be objected that so much armour, and such heavy guns at the ends of a ship, will be a disadvantage, if such craft had to fight at sea.

To obviate this the ends may be cut down, as in the model, No. 2, and the guns placed in a deflecting casemate amidships; in this instance the position of the guns will depend upon the size of the ship and their weight. Such a form seems very likely to represent the future line-of-battle ship: deflecting-casemate, and sloping-sides certainly offer the best chance of keeping out modern projectiles.



DEFLECTING ARMOUR-PLATED SHIP WITH CENTRAL CASEMATE.

(Scale $\frac{1}{8}$ of an inch to a foot.)

There is another point to which I wish to direct the attention of the members, and that is the oft-repeated idea of conversion. This has been the subject of much debate, and is certainly well worth attention, on the score of economy. There are many very splendid hulls yet remaining from the fleets of former days; the best of them may be made to do efficient duty as deflecting-sided ships.

I have shown a design for conversion in the drawing before you. This is the mid-ship section of a line-of-battle ship, and upon it I have placed a section of a deflecting-side. What I would propose, is to cut down all the upper decks and sides as low as the lower deck, and upon the remaining bottom, build an independent system of angular sides, so arranged and so fitted that when the bottom had become by age unfit to give safe support to the iron structure above, a new iron bottom of the usual form may be added. Thus you will utilize the present ships without destroying the added structure for reconversion again. This, I think, is a very simple and cheap conversion, and may certainly be tried at comparatively little cost. In submitting this idea for the conversion of some of the finest of our wooden ships, there are two important essentials; the first is the preservation of the present fixed machinery, which need not be moved out of the ship, and the second, that the added structure would be available for a new hull, when the timber had become too old to be longer trusted. The details of such a system of conversion are not shown in this drawing, details being a matter of professional arrangement. Such a system is, of course, like all other systems, open to criticism, and hence I have ventured to introduce it, that in the discussion, which usually follows a paper read at this Institution, some notice may possibly be taken of it.

To those who contemplate building armour-plated ships, it would appear desirable to consider the question, whether vertical sides, even when plated with the thickest armour, will keep out the most modern projectiles. The experiments at Shoeburyness answer that question indisputably. Will naval powers, on the other hand, agree to use small guns? this would be a desirable arrangement, but we must consider it impracticable.

I may then, as an advocate of the deflecting-sided system, most earnestly urge, even on the score of humanity, that it should be tested in an efficient manner. It can hardly be expected that an ordinary individual should, at his own cost, enter upon the construction of a full-size target. It must be acknowledged that in the production of such models and experiments as are here shown, a considerable sum

has been already expended; and although they show what the result would be in the actual ship, yet a target made on the principle of this model of a deflecting-sided ship, would at once demonstrate its advantages. There is certainly no naval power in the same financial position as England. To such, a shot-proof ship of moderate cost would be an essential of the greatest moment; and to such I would say before expending large sums in ships of doubtful vulnerability, consider fairly whether double deflection is not the true form of construction for economy, seaworthiness, invulnerability, difficulty of capture by boarding, and last, though not least, comfort for the crew.

It is very well known that naval powers generally are not only seeking every kind of information upon the subject of ships and guns, but are actually preparing themselves with both as rapidly as circumstances will admit. Take, for instance, the fact of the Americans possessing a host of 15- and 20-inch smooth-bores. The fact also of the Prussians being engaged in the manufacture of the largest guns our Shoeburyness experiments have taught them the necessity of. These and similar circumstances show how important it is that any possible contrivance, having a chance of success, should be investigated, that England may not be compelled to concentrate her energy at an enormous sacrifice when a naval panic places her at a disadvantage. The public, if we may judge from the interest taken in this question by the paper, quite understand its importance.

I remember to have read in the *Times* of December 8, 1866, the following remark:—"We learn from experiments now reported, that a large percentage of shots would be rendered practically harmless by such an inclination of a ship's side towards the muzzle of a hostile gun." Now this is what I have endeavoured to urge for the past 16 years, and I hope, in the course of a few more, to see such a system adopted. Every day's experience confirms its importance, and those who are conversant with these subjects, cannot fail to acknowledge its practicability and usefulness, for, however much we may rely on the pluck and daring of the British Officer—qualities we know they possess in the highest possible degree—there is another element we must not forget, that of the British seaman, once a numerous race, that seem, from some unexplained cause, to be passing away, and hence the necessity of giving those we have, a fair chance when called upon to fight the enemy. This too, is an argument in favour of a ship that can successfully keep out the hostile shot. Skilled seamen and gunners take some years to produce, and when educated for such duties at great cost and care, are certainly more likely to be of service to the State in a shot-proof ship than in a ship vulnerable at all points.

The great and rapid changes which have taken place, and which will, doubtless, continue to take place in the design and construction of ships suitable for the purposes of war, offer to a wise statesman a subject of deep investigation. Naval tactics, like military evolutions, when skilfully performed, are said to give important advantages; but these can hardly be accomplished without such material in the shape of ships and guns as shall ensure success. England has the means to obtain, and the desire to possess—her statesmen all acknowledge

that no circumstances should prevent the possession of—the most powerful fleets. Her people have at all times been most ready to bear any cost for such efficiency, and although the ships now built are grand and magnificent structures, reflecting the highest possible credit upon those gentlemen under whose care and judgment they have been designed, and whose experience had given such great perfection, yet their vertical sides have an acknowledged vulnerability. Let us hope then that some plan will be suggested to keep out those fearful shells, and, in the absence of any better, I have been permitted by the Council of this most useful and valuable Institution to introduce to your notice these models and drawings. They explain a system I have worked at for the past 16 years, and I claim to add that the result of experiment in every variety of form, shows that a glacis all round a ship externally covered with timber, will cause projectiles to ricochet, and that such is the system that offers the best chance of success against the guns of the present day.

Description of Targets.

Targets 1 and 2 are representatives of 6-inch targets; that is, they are plates $\frac{1}{2}$ inch in thickness, No. 1 being of iron and No. 2 of homogeneous metal tempered. They were fired at with the same shot and charge, No. 1 being penetrated and No. 2 only bulged, thus proving the great advantage of homogeneous metal.

Targets No. 3 and 4 are representatives of 10-inch targets. No. 3 being a naked plate and No. 4 protected with timber equalling 12 inches. The first shot at No. 3 was of cast-iron, similar to that marked 1 on the board, and the remains of the shot fired are placed with it. No. 2 shot of this series was of wrought-iron, the shot fired is also placed on the board; the impression on the target with both the cast- and wrought-iron shot is small. No. 3 shot was of tempered steel, this penetrated the target; the shot is also on the board. No. 4 and 5 were fired at an angle of 10° and did not penetrate. No. 4 target, lined with wood, was not penetrated, and the shot is still in the metal, thus proving that the wood is an advantage even in a vertical position.

No. 6 target represents the angular sides of a ship; one side of this target is faced with wood, the other is naked. Upon examination, it will be seen that the wood has entirely prevented the shot from even touching the metal. The naked half of this section was also fired at, and the result was a small indentation only; there can be no doubt, therefore, that a similar result would be found in firing at an actual ship with a full-size gun.

No. 5 target is a representative 12-inch target. The first shot only got half way through, but, with an extra half charge of powder, the second shot, as you see, very nearly penetrated. Both these shots were uninjured.

Mr. HYDE: If you will permit me I will now further explain this target (No. 6) representing the side of my ship, as the experiment was a most remarkable one. In firing at this target, the wood actually made the shot ricochet. This is the

piece of wood placed upon the target in an early experiment. If you examine it, you will find that the shot has simply grooved out the wood, and the fibre is torn up, but it failed to penetrate the wood, it did not touch the iron. That result was so astounding and marvellous, as showing that mere vulgar wood would keep a shot out of a ship, that I repeated the experiment on two or three occasions, and found the same results. You will notice that there were two shots fired here, and they failed, both of them, to penetrate the wood,—they ricocheted from the surface and passed away.

It might be asked: what would be the effect of a plunging shot? This (pointing to a target) is the effect of a plunging shot. A shot was fired so as to show the effect, but it failed to get through the iron. It went through the wood, but not through the iron.

This diagram shows the thickness of the wood, a foot in thickness, as would be used in my construction. A shot penetrating, assuming it went in a straight line, would have to go through 2 feet 6½ inches. Probably it would ricochet, as in this case, pass off and go away without reaching the plate at all. This diagram represents the full-sized plate of 3 inches. The midship section shows more clearly how the armour-plates would be secured, and the wooden facing on the outside.

The CHAIRMAN: If any gentlemen would like to make any remarks or ask any questions, Mr. Hyde will no doubt answer them satisfactorily.

The points on which I should like to be enlightened are, firstly, what power of training right and left will there be in this gun with that surface to point through? I do not quite see that there is the same power of training right and left here as you would have in a vertical side.

Again it seems to me that such a ship as the one represented would be more suited for coast defence, than for sea-going purposes, inasmuch, as I think in the first place she would roll more, and her upper deck would probably be swept continually. These are two of the points I should like to hear more about. Do I understand also that no shot ever penetrated the iron through the wood? As for instance there: (pointing) what became of those shot? Did they lodge in the wood, or go on away, or did they remain? I see one has remained.

Mr. HYDE: This shot must have fallen out; it could not be found.

The CHAIRMAN: I conceive that the ricochet of the shot would be very mainly determined in this case by the fibre of the wood being in that particular line, but supposing the fibre to be the other way, I do not suppose there would be any necessity for placing the wooden *facing* with the fibre that way; but supposing it were, I presume the shot would have a better chance of penetration than it would with the fibre placed in the way in which we see it.

Captain BEAMISH, R.N.: Mr. Hyde has pointed out a piece of wood through which a shot did not go, was that shot fired vertically at that piece of wood, and had it armour plating behind?

Mr. HYDE: The piece of wood was placed in the position you see it on the model.

Captain BEAMISH: May I ask what is its thickness in proportion to the iron?

Mr. HYDE: Three inches of iron and twelve inches of wood.

Captain BEAMISH: Another thing that struck me about the construction of vessels on the principle before us is this, that at sea they would be very likely to be severely struck in the rise and fall of heavy seas, in consequence of the shape of the vessel being so very much over-hanging. As far as my experience goes, vessels with large sponsons offer very great resistance to the sea, and it appears to me that this vessel, though it certainly would offer immense advantages in the way of deflecting shot, offers the disadvantages all round that a vessel with an over-hanging stern offers only at the stern, or which one with an over-hanging bow offers only at the bow. I do not know whether Mr. Hyde has had any opportunities of testing it, he cannot have done it with mere models, but it strikes me that with that construction there would be a very great strain upon the vessel from over-hanging weights, such a strain as comes to a vessel which has an over-hanging stern or bow, more particularly when the guns are run out.

The CHAIRMAN: I was going to mention that at sea, be the ship what she may, with the wind on one side, she would always heel over a great deal, to say nothing

of the rolling, and in that case I presume she would suffer much more from the enemy's artillery, because the shot would be very liable to go below that deflecting surface, and the deflecting surface under those circumstances would not be at the same invulnerable angle that it is when she is on an even keel. That is supposing she was a sea-going ship; for coast defence it would not be so.

Mr. J. B. WILSON: I would ask whether exactly the similar results would be attained with full-sized artillery and full-sized targets as were obtained with the model, or whether it is not a matter of calculation and also of experiment, whether full-sized guns would not prove more destructive to full-sized targets than was found in the case of the model targets.

Mr. SAMUEL J. MACKIE, Associate I. C. E.: With reference to what the last speaker said with regard to the full-sized targets, having had great experience in these things at Shoeburyness, I must confess my very great surprise at finding that these targets, particularly No. 3, as any one may see, so accurately show in miniature the various forms of perforation made upon the plates of larger size. If any one will look at the back of that plate they will see the same four rays breaking out, and similar bulgings at the back; they will see a large circular disc broken away, and on examining the front of the plate, will perceive the same ripple mark round the hole in a manner marvellously like those which are witnessed in the experiments at Shoeburyness.

With regard to that plate, and the wood that is put in front of it, it has caused me some astonishment. If I understand it rightly, it represents a 3-inch or 4-inch plate covered with 12 inches of timber. We know perfectly well if a plate of 3 or 4 inches thickness, backed with 12 inches of timber, is hit direct from a 600-pounder, the shot will pass through it as through pasteboard. If you get such results in practise from a 600-pounder it will show that the deflection of the plate has an exceedingly high defensive value. Of course, when allusion is made to experiments on a small scale, I cannot for one moment admit that it would prove any economy to the nation to try experiments on a small scale. Experiments on a small scale are suitable for inventors, and have been carried out by many of them, as by Major Palliser and others, before their inventions were brought forward to the public or to the Government, but experiments on a large scale must be necessary before practical works could be engaged upon. No acceptance of any principle could ever be made upon a small model, it must and ought properly to be tried on a large scale. With regard to the over-hanging shape of the stern of the vessel, and of the sides and bow, it is a point upon which I think it would be well to have some further consideration than the mere over-hanging of the sponsons of a vessel would give us. There seems to me to be in the over-hanging of a vessel of this kind an enormous dead weight, which is very different to the over-hanging sponson of an ordinary ship. This dead weight I apprehend is a certain amount of weight to be elevated against gravitation, and which action must to a certain degree absorb much of the momentum of the striking object, or wave. I think that is a point worthy of investigation with regard to a structure of this kind. There evidently is a great deal of defensive resistance to be got by angulating the target, we have seen this at Shoeburyness in the 8-inch Warrior target, part of which is at an angle of $37\frac{1}{2}$ degrees, representing the bow of a ship, for in no case did the Palliser shot penetrate that. In fact, the ogival head of a Palliser shot especially, is pretty nearly certain to be deflected in consequence of the form of the head. This happens even from as yielding a surface as water. I had no idea of speaking this evening, but these are some of the points which appear to me to be worthy of consideration with respect to the plan submitted.

Mr. HYDE: Referring to an observation you, Mr. Chairman, were kind enough to make, with regard to the training of the gun, of course I need not tell you that to give a gun a large amount of training, you must have a very large port, or adopt the muzzle pivoting system: the large port is a point in the structure of ships that one generally tries to avoid. I might say the modern application of the double screw or the hydraulic system of steering almost prevent the necessity of giving a ship a very large port, for she can be twisted and turned with the double screw almost as readily as the turret itself. However, the trainage here would be, perhaps, a point, fore and aft, unless the port was made large.

As regards your remark about the fibre of the wood, in making such a structure, no one would, for a moment, place the timber what we call practically, fore and aft—it would all be vertical. If a shot struck the side of a ship, where the timber had been fixed fore and aft, it would possibly destroy a dozen planks, whereas, if the plank was placed vertically one only, or one and a half, or two might be destroyed. So that in all cases the fibre of the wood would be direct to the flight of the shot as it is placed on this particular surface.

As to the rolling of the ship at sea that is a question which it is almost impossible for anyone to answer satisfactorily. We can only say that merchant ships, having sponson sides, are known to be easy ships in a sea-way; and as an illustration of that, I would allude to a ship navigating our own River Thames. I think it is the "Lion." This is a ship with a sponson side. I have gone on board that ship, and asked the sailors how she behaved in a sea-way, and they all say the ship was the most buoyant craft that they ever sailed in. We do know, as a fact, that small boats, the sides of which are mainly sponsoned, so to speak (the greatest breadth of a small boat being just at the gunwale), we know that little boats live in a sea that a big ship would founder in. That is a well-known fact, so that as far as my judgment and my inquiry go, ships with sponson sides would be more buoyant and more seaworthy than those with vertical sides only. Of course, these vessels are supposed to present the smallest possible surface to the enemy, and hence would swim, perhaps, three or four feet out of water. The point is to keep a shot out of a ship. If you are obliged to put 14-inch armour or 12-inch armour upon a ship, she must be very large, the displacement must be very extensive, and even then we know that vertical structures are still vulnerable. Hence this is resorted to. I do not mean to say that there are not disadvantages. A heavy sea rolling over—that cannot possibly be avoided. You cannot have the old wooden structure and the armour-plated shot-proof ship too. If you want a ship made shot-proof, you must either give her a form of this kind, or else you must have her sides so thick that the structure must be monstrously big—some 8,000 or 10,000 tons—to carry it.

As regards the heeling of a ship of this description, and the exposing a weak part of her structure, all ships are the same. If you take a broadside ship of the present form, she is just the same; if she heels over, she exposes her weak points below. If you give a ship of this class sufficient beam she would not expose her weak points so frequently as a vertical-sided ship, and these ships must have more beam to carry their weights, so that the weakness below the water is much less than it would be in an ordinary ship.

As regards getting the same result from the model that you would from a big gun—well, that is a question of deep research, which I confess I am not able to answer off-hand. All I can say is this, that with a gun an inch to the foot, and a target an inch to the foot, you get the same results they have got at Shoeburyness. If you reduce your 600-pounder to half the size, you get half the duty; if you reduce it to a quarter the size, you get a quarter the duty, and you may go on down to one-twelfth the size. I think the argument is a good one, and I think it is highly probable because the results are the same. If the results were not the same, then I might say the experiment was defective, but with a similar result as to the penetration of a plate equal to a 10-inch plate—the only plate they have fairly penetrated is a 10-inch plate—the 12-inch plate or the 15-inch plate they did not quite penetrate, it was broken up in fragments,—but the 10-inch plate they have penetrated: so we have here, the shot goes through it, and I have no doubt experiments, however numerous, made under similar circumstances, will yield the same results. I have brought the targets, I have brought the gun, I have brought the shot, and the result is here. Anybody may make the same experiment.

The only reason the overhanging form is given in this particular mode of construction is simply to get rid of the shot; we know we cannot get rid of it in any other way. However thick, or however big you may make your plates, gentlemen, at Woolwich, say "We will knock them all to pieces if we cannot get a shot through." Therefore, we must make something that will keep the shot out—of course, there might be something better,—but in the absence of any better, I present

you with this. If you have any better scheme for keeping shot out of a ship, then I make my bow: at present I say this is the best.

It has been noticed that the weight at the ends may be disagreeable. I am not prepared to say it would be disagreeable, especially for coast defence, because in a ship entirely devoted to harbour duty, or coast defence, there is no probability of her getting into Atlantic waves. But in the event of a ship going to sea in a gale of wind, take the ends off and we present you with a form of this description—we put a casemate in the middle with a glacis all round it. Remove the weight from the ends and keep it in the centre; but I think both plans equally good, and I think would do equally good and efficient duty under any circumstances.

The CHAIRMAN: I think the meeting will join with me in giving their thanks to Mr. Hyde for his very able lecture upon this subject. It seems to me that he has gone as near as possible to the great object of keeping the shot out of the ship. With regard to the material, the only doubt that can be thrown upon this to my own mind, is that the material is stronger in proportion as it is smaller than it is on a great scale, but excepting that, it seems to me that these experiments are very conclusive. Certainly, they are very good as guides for larger experiments on a grand scale. I should think it would be very desirable to have experiments on the full-sized scale afterwards, before we could fully and entirely trust these means for ship-building. The only doubts I, as a sailor, have, are, that we have so many other problems to deal with when we go to sea, besides keeping the shot out of the ship, but as far as keeping the shot out of the ship goes, that, no doubt, can be tolerably accomplished with deflecting sides. You will I am sure, join with me in thanking Mr. Hyde.
